UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW
ATLANTA, GEORGIA 30303-3104

4WD

R. F. Ritchie, Captain, SC, USN
Commander, Defense Distribution Depot Susquehanna
2001 Mission Drive
New Cumberland, Pennsylvania 17070

Re: EPA Concurrence on the Five-Year Review Report for the Interim Remedial Action at the Defense Depot, Memphis Tennessee, Dunn Field Site

Dear Captain Ritchie:

A Five-year review of the referenced remedial action is required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In cooperation with your staff at the Memphis Depot Superfund Site, the United States Environmental Protection Agency (EPA) Region 4 participated in development of the Five-Year Review Report for the Interim Remedial Action at Dunn Field. This review was performed in accordance with EPA guidance, and the resulting document meets the statutory requirements for such a review.

EPA concurs with the findings of the five-year review of this interim remedial action. We look forward to working with the Defense Logistics Agency and the Tennessee Department of Environment and Conservation to complete all remedial actions necessary to facilitate the transfer and reuse of this BRAC property.

Sincerely yours,

Jon D. Johnston, acting

Winston A. Smith
Director
Waste Management Division
U.S. EPA Region 4

cc: James Morrison, TDEC/Memphis

10054866

DEFENSE LOGISTICS AGENCY
DEFENSE DEPOT SUSQUEHANNA PENNSYLVANIA
OL, MEMPHIS
2163 AIRWAYS BOULEVARD
MEMPHIS, TENNESSEE 38114

IN REPLY
REFER TO DDSP-D

January 22, 2003

MEMORANDUM FOR TURPIN BALLARD (USEPA – Region 4) AND JAMES MORRISON (TDEC)

SUBJECT: Final (Rev. 2) Dunn Field – Five-Year Review

The Final (Rev. 2) Five-Year Review for Dunn Field (Operable Unit 1) of the Memphis Depot is attached. The document will be included in the Administrative Record for Dunn Field.

For more information, please contact Clyde Hunt or me at (901) 544-0617.

JOHN P. DE BACK
BRAC Environmental Coordinator

Attachment on CD ROM:
Final Dunn Field Five-Year Review

Distribution:
DDC (Memphis) (2 copies)
U.S. EPA (3 copies)
TDEC (3 copies)
DDC (New Cumberland) (3 copies)
USAESCH (3 copies)
USACE-Mobile (2 copies)
Memphis Depot RAB (20 copies)

Memphis Depot
Dunn Field

Five-Year Review

Defense Distribution Center (Memphis)

January 2003 — Rev. 2

CH2MHILL

U.S. Army Engineering and Support Center, Huntsville

U.S. Army Engineering and Support Center, Huntsville
Contract No. DACA87-02-D-0006
Task Order No. 02

E092002012ATL

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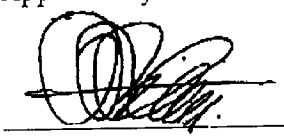
Executive Summary

The March 1996 Interim Record of Decision for the Dunn Field of the Defense Distribution Center (Memphis) (formerly known as the Memphis Depot) included incremental removal of contaminants from the fluvial aquifer, decrease of risk by mitigating the spread of constituents toward the Allen Well Field, and creation of a hydraulic barrier to prevent contamination in the fluvial aquifer at Dunn Field from reaching the Allen Well Field (approximately one-half mile west of Dunn Field). A groundwater extraction system designed to satisfy these goals was initially constructed in 1998 (Phase I) and was expanded in 2000/2001 (Phase II). The interim groundwater extraction system began operation in November 1998 and continues to operate as of the date of this five-year review. The trigger for this five-year review was the actual start of construction on January, 1998.

While over 300 pounds of VOCs have been removed from groundwater by the IRA from 1998 to 2002, the extraction system does not provide complete control over groundwater flow and the spread of contaminant constituents in the fluvial aquifer from the western perimeter of Dunn Field. As a result contaminant levels have been increasing in a few monitoring wells downgradient and offsite of Dunn Field. Since the extraction system has not completely contained the spread of contaminants toward the Allen Well Field, the remedy does not fully satisfy the principal IRA goals. The only goal that is being met by the remedy is incremental removal of contaminants. However, because there is no current use of, nor plan to use, the shallow groundwater as a drinking water supply, and because local ordinances restrict installation of private wells, the IRA is considered protective in the short term.

A fully protective remedy for all media will be selected in the final ROD for Dunn Field, which is expected to be completed before the end of FY 2003.

Approved by:



Date:

17 January 2003

R.J. RITCHIE
Captain, SC, USN
Commander

1.0 Background

1.1 Introduction

The former Defense Distribution Center (Memphis) (referred to as the Memphis Depot or Depot) was proposed for inclusion to the National Priorities List on October 14, 1992, by the U.S. Environmental Protection Agency (EPA), bringing the facility within the Superfund program. As a result of its status as an NPL site, the Depot entered into a Federal Facilities Agreement (FFA) on March 6, 1995. The signatories to that agreement, the Defense Logistics Agency (DLA), EPA, and the Tennessee Department of Environment and Conservation (TDEC), agreed that investigating and remediating all applicable sites at the Depot would proceed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. In 1996, an Interim Remedial Action (IRA) Record of Decision (ROD) was submitted for a groundwater removal action at Dunn Field (CH2M HILL, January 1996).

Consistent with CERCLA as amended by the Superfund Amendment Reauthorization Act of 1986 (SARA), Section 121(c) and Section 300.430(f)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a statutory five-year review to evaluate the effectiveness of the IRA is required for this site. This Five-Year Review has been completed in accordance with EPA Document 540-R-01-007, *Comprehensive Five-Year Review Guidance* (June 2001). Notification of the beginning of the Five-Year Review process was provided to the community at the June 20, 2002, Restoration Advisory Board (RAB) meeting in Memphis, TN.

This report presents information collected during five-year review activities performed by CH2M HILL for the U.S. Army Corps of Engineers (USACE), Huntsville Center. The review was intended to confirm that the interim remedial action and associated performance standards are being achieved and that current site conditions are protective of human health and the environment. This is accomplished by: (1) technical review of existing documents and data and standards; (2) site reconnaissance to evaluate the remediation; (3) evaluation of site-specific factors (i.e., scope of O&M, frequency of sampling and inspections, and monitoring parameters) to assess if the remedy implemented remains operational, functional, and protective; and (4) five-year report preparation.

1.2 Site Location and Description

1.2.1 Location

The Memphis Depot lies approximately 5 miles east of the Mississippi River and just northeast of the Interstate 240–Interstate 55 junction in the south-central portion of Memphis, approximately 4 miles southeast of the central business district and one mile northwest of Memphis International Airport (Figure 1-1).

Dunn Field, comprising 64 acres of undeveloped land, is immediately adjacent to the Main Installation (MI) of the Memphis Depot, across Dunn Avenue, to the north-northwest portion of the MI. Dunn Field is bounded by the Illinois Central Gulf Railroad and Person Avenue to the north, Hays Road to the east, and Dunn Avenue to the south. Dunn Field is partially bounded to the west by: (1) Kyle Street; (2) Memphis Light Gas and Water (MLGW) powerline corridor (which bisects Dunn Field); (3) undeveloped property; and (4) a commercial trucking facility (Figure 1-2).

Dunn Field was divided into three separate areas within the Remedial Investigation (RI) to assist the investigation of previous activities (CH2M HILL, July 2002). These areas are known as the Northeast Open Area, Disposal Area, and Stockpile Area (Figure 1-3).

1.2.2 Hydrogeologic Setting

A thorough discussion of the regional and local geologic characteristics of Memphis and Memphis Depot areas can be found in Section 2 of the Dunn Field RI report (CH2M HILL, July 2002). There are four primary geologic and stratigraphic units underlying Dunn Field, however, only information on the upper two units is presented below. For more information on the geologic units underlying Dunn Field, the reader is referred to Section 2 of the Dunn Field RI report (CH2MHILL, July 2002).

The uppermost geologic unit at or near ground surface at Dunn Field is loess deposits, consisting of brown to reddish brown low-plasticity clayey silt (ML) or low-plasticity silty clay (CL). Portions of the loess may also be described as fine sandy clayey silt. Based on data from the RI monitoring well installation effort, the loess is continuous throughout the entire Memphis Depot area. The loess deposits range from 10 feet thick in the southwestern portion of Dunn Field to 36 feet thick at the western boundary of Dunn Field and are on average about 20 to 30 feet thick.

Fluvial deposits underlie the loess. The unit is composed of two generalized layers that can be identified throughout the subsurface of the Dunn Field area (as shown in Figures 2-8a through 2-8m of the Dunn Field RI):

- Reddish brown silty sandy clay to a clayey sand; and
- Yellow brown, orange brown, and red, poorly to well graded (less than 5 percent silt or clay), fine- to coarse-grained sand and orange brown gravelly sand to sandy gravel.

The upper layer is a silty, sandy clay that transitions to a clayey sand deposit. This layer represents a transition zone between silt-dominated loess and sand and gravel of the fluvial aquifer. Within the Dunn Field boundaries, this layer ranges from about 3 feet thick at MW-56 (southwest corner of Dunn Field) to 20 feet thick at MW-58 (southwest corner of Dunn Field). Underlying this upper layer is a second unit composed of layers of sand, sandy gravel, and gravelly sand, known as the fluvial deposits. This second unit has an average thickness of approximately 40 feet underneath Dunn Field and along the eastern and western boundaries.

The uppermost aquifer at Dunn Field is the unconfined fluvial aquifer, consisting of saturated sands and gravelly sands in the lower portion of the fluvial deposits. The fluvial aquifer provides water for domestic and farm wells in rural areas (Kingsbury and Parks, 1993), but is not used as a drinking water source within the City of Memphis, including the

area surrounding the Depot. Saturated thickness of the fluvial aquifer is variable across Dunn Field and is controlled by the configuration of the uppermost clay in the Jackson Formation/Upper Claiborne Group. Maximum saturated thickness of the fluvial aquifer onsite is 18.5 feet along the eastern edge of Dunn Field. Along the western perimeter of Dunn Field, the maximum saturated thickness is 7.3 feet, however the groundwater extraction system is active on this edge of Dunn Field. Offsite and to the north and west of Dunn Field, the maximum saturated thickness of the fluvial aquifer is 25.4 feet.

Information describing the groundwater conditions and resources of Shelby County was obtained from Section 2 of the Dunn Field RI report (CH2MHILL, July 2002). The Memphis area is located within a region that includes several aquifers of local and regional importance. An alluvial aquifer is located throughout Memphis, however the distribution is limited to the channels of primary streams; therefore, it does not occur at Dunn Field. The reader is referred to Section 2 of the Dunn Field RI report (CH2M HILL, July 2002) for a more a thorough discussion of the regional and local hydrogeology in the Memphis area.

1.3 Site History

1.3.1 Operational History

The Depot originated in the early 1940s. Its initial mission was to provide stock control, storage, and maintenance services for the Army Engineer, Chemical, and Quartermaster Corps (Memphis Depot Caretaker, 1998). From 1963 until closure in September 1997, the facility served as a major field installation for the DLA for shipping and receiving a variety of materials (U.S. Army Toxic and Hazardous Materials Agency [USATHAMA], 1982).

The Depot received, warehoused, and distributed supplies common to all U.S. military services and some civil agencies located primarily in the southeastern United States, Puerto Rico, and Panama. Stocked items included food, clothing, electronic equipment, petroleum products, construction materials, and industrial, medical, and general supplies. Approximately 4 million line items were received and shipped by the Depot annually; total shipments amounted to about 107,000 tons of goods per year. In-stock inventory at the facility was worth more than $1 billion.

Disposal activities at Dunn Field began in July 1946 when 29 mustard-filled German bomb casings were destroyed and buried (Sites 24-A and 24-B). Three railcars were identified as containing leaking munitions and were transferred to the Memphis General Depot for proper handling. A total of twenty-four 500-kilogram (kg) and five 250-kg bombs were destroyed (USACE, 1995). After draining and destruction operations were completed, all mustard-contaminated items (wood, clothing, etc.) were placed into the slurry pit and burned.

During the early to mid-1950s, Chemical Agent Identification Sets (CAIS) were allegedly disposed of and buried at Dunn Field at Site 1 in the Disposal Area portion of Dunn Field. The CAIS allegedly contained small glass ampoules of diluted mustard, lewisite (a vesicant chemical agent), chloropicrin, and phosgene, which were stored in sealed cylindrical metal containers (PIGS). CAIS stocks found to be leaking or broken during periodic inspection were reportedly buried at Dunn Field (USATHAMA, 1982). The damaged CAIS may have

been broken up and neutralized with chlorinated lime; however, reports indicate that on at least five or six occasions the sets were placed into the pits intact (USACE, 1995).

The Chemical Warfare Materiel (CWM) disposal pits were located in the Disposal Area section of Dunn Field and the Stockpile Area portions of Dunn Field (Sites 1, 24-A, and 24-B). Section 1.3.4 of the Dunn Field RI presents additional information on the CWM at Dunn Field. According to information provided by USATHAMA (1982) and USACE (1995b), the remains of destroyed (burned or detonated) explosive ordnance (OE) were also buried in pits in the Disposal and Stockpile Areas . Reports indicate that the OE consisted of a 3.2-inch mortar round, smoke pots, chloroacetophenone (CN) canisters, and hand grenades (smoke) and "souvenir ordnance". Additional information on the potential presence of this OE can be found in Section 1 of the Dunn Field FS.

In addition to that described above, other chemicals associated with the use of chemical agents such as Decontaminating Agent Non-Corrosive (DANC) were buried in Dunn Field. The decontaminant DANC disposed of at Dunn Field is an organic N-chloroamide compound in solution with 1,1,2,2-tetrachloroethane (PCA). DANC typically contained 90 percent to 95 percent 1,1,2,2-PCA (also known as acetylene tetrachloride). A mixture similar to DANC formulations (S-210 suspension formulation) contained tetrachloroethene (PCE). Use and disposal of chlorinated lime, super tropical bleach (STB) and calcium hypochlorite (HTH) is documented at Dunn Field. Food stocks, paints/thinners, petroleum/oil/lubricants (POL), acids, herbicides, mixed chemicals, and medical waste were also destroyed or buried in pits and trenches at Dunn Field (USACE, 1995). These are the sources for the chlorinated volatile organic compounds (and their degradation products) found in the soil and groundwater in and beneath Dunn Field. These include 1,1,2,2-PCA, trichloroethane (TCA), PCE, trichloroethene (TCE), dichlorothenes (DCE), vinyl chloride, carbon tetrachloride and chloroform. Table 1-1 lists and describes the sites at Dunn Field (OU-1), including the disposal sites.

1.3.2 Regulatory History

From 1989 through 1990, Law Environmental through a contract with the U.S. Army Engineering and Support Center (USAESCH) conducted an RI at the Memphis Depot. In January 1990, EPA Region 4 conducted a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) at the facility through a contract with A.T. Kearney, Inc. (EPA, 1990).

On September 28, 1990, the Memphis Depot was issued a RCRA Part B permit (No. TN4 210-020-570) by EPA Region 4 and TDEC. Subsequently, in accordance with Section 120(d)(2) of CERCLA, Title 42, Section 9620(d)(2) of CERCLA, and Title 42, Section 9620(d) (2) of the United States Code (USC), EPA prepared a final Hazard Ranking System (HRS) Scoring Package for the facility. On the basis of the final HRS score of 58.06, EPA added the Memphis Depot to the NPL by publication in the *Federal Register* (FR), 57 FR 47180 No. 199, on October 14, 1992.

On March 6, 1995, a Federal Facilities Agreement (FFA) under CERCLA, Section 120, and RCRA, Sections 3008(h), and 3004(u) and (v), was reached by EPA, TDEC, and the Memphis Depot. The FFA identified a list of sites for investigation (see Table 1-1). The FFA also outlined the terms by which the investigation and clean-up will be conducted. The selected

interim remedy addresses only groundwater that was contaminated as a result of past disposal practices at the site, and any environmental contamination not addressed in this Interim Remedial Action will be addressed in the final remedy for the site.

In July 1995, the Depot was placed on the list of Department of Defense (DoD) facilities to be closed under the Base Realignment and Closure (BRAC) Act, indicating that the facility was to be closed and converted to potentially different ownership and uses. The BRAC Cleanup Team (BCT) was developed to implement BRAC requirements, which include identifying methods for expeditious property transfer and reuse. The BCT is composed of representatives of the Defense Logistics Agency (DLA), EPA, and TDEC. Therefore, in addition to meeting CERCLA requirements, environmental restoration at the facility must also comply with specific requirements for property transfer in accordance with Public Law 501-510 under Title XXIX, enacted in 1990.

Other important regulatory events for Dunn Field are described in the following subsections.

1.3.2.1 Interim Remedial Action

In 1996, an IRA ROD was submitted for a groundwater remedial action at Dunn Field (CH2M HILL, January 1996). The ROD provided the basis of design for the components associated with the IRA for Dunn Field. The ROD was finalized in January 1996 and was signed in April 1996. As presented in the document, the Dunn Field interim ROD remedial action objectives are "to incrementally remove contamination from the Fluvial Aquifer, to decrease risk by mitigating the spread of contamination towards the Allen Well field, and to create a hydraulic barrier to prevent contamination in the Fluvial Aquifer at Dunn Field from reaching the Allen Well Field."

The final design for Phase I of this IRA was completed by CH2M HILL in August 1997, and included the installation of seven groundwater extraction wells (RW-3 through RW-9), one pre-cast concrete building, an underground conveyance system, flow measurement and control systems, and associated civil, electrical, and instrumentation/controls work. The extraction system was constructed by OHM/International Technology (IT), under contract with USACE-Mobile District, from January 1998 through October 1998. The interim groundwater extraction system began operation in November 1998 and continues to operate as of the date of this five-year review.

An updated final design (Phase II) of the groundwater interim remedial action was completed in January 2000 (CH2M HILL, January 2000), which included the addition of four extraction wells and associated electrical, mechanical, and instrumentation/controls components. Four new recovery wells (RW-1, RW-1A, RW-1B, and RW-2) were installed south of recovery well RW-03 by OHM/IT in late 1999 and early 2000. These wells were added due to the groundwater contamination detected in the southern portion of the Disposal Area and the northwest portion of the Stockpile Area. The expanded groundwater extraction system was constructed by Jacobs Engineering Group (Jacobs), under contract with USACE-Mobile District, from September 2000 through February 2001. The new extraction wells were brought on-line in the first quarter of 2001 and were fully functioning in June 2001 (Figure 1-4).

Operation and maintenance (O&M) activities have been conducted since the system went online. The original O&M Plan (CH2M HILL, May 1998) for the groundwater extraction system outlined activities that would allow evaluation of the groundwater extraction system performance. The plan was amended in 1999, again in 2000, and a third time in August 2001. The performance activities that are conducted now (2002) include semi-annual sampling of groundwater at 26 specific monitoring wells and 11 recovery wells. Other activities are also included as part of the O&M of the system. For example, water levels are routinely measured on a biweekly basis from 53 monitoring wells on and surrounding Dunn Field and in another 17 wells on a monthly basis. In addition, total system effluent samples are collected (monthly from startup through 2000, and quarterly for 2001 and 2002) from the conveyance system for analyses prior to discharge to the City of Memphis POTW, per the Industrial Discharge Agreement between the Memphis Depot and the City of Memphis.

From system startup in 1998 through August 31, 2002, the system has pumped approximately 125,934,000 gallons of groundwater from the fluvial aquifer beneath Dunn Field and discharged to the POTW. Through August 31, 2002, an estimated total of 378 pounds of VOCs have been removed from the fluvial aquifer on Dunn Field (Jacobs, September 2002).

1.3.2.2 CWM Removal Action

An Engineering Evaluation/Cost Analysis (EE/CA) was performed by Parsons Engineering Science (Parsons), under contract with USAESCH, in June 1999 to: (1) assess whether CWM contamination was migrating from the CWM disposal pits at Dunn Field; (2) analyze risk management alternatives; and (3) recommend feasible CWM remedial alternatives for contaminants found to be present.

A non-intrusive geophysical investigation was performed on the western half of Dunn Field between February and July 1998. Samples of soil and groundwater were also collected. No CWM-related compounds were detected in the background samples. Based on the analytical results from the samples, no migration of CWM or breakdown products from the disposal pits or trenches has occurred.

UXB International, under contract with the US Army Corps of Engineers – Huntsville Center, conducted remedial measures from mid-2000 to mid-2001 at Sites 1, 24-A, and 24-B to reduce or eliminate the potential CWM risk posed by these wastes. The CWM remedial actions at these sites are documented in the *Final Chemical Warfare Materiel Investigation/Removal Action Report*, dated December 2001, prepared by UXB International, Inc. The conclusions from this report are as follows:

- Site 1 – This site was suspected of containing CAIS containing small quantities of diluted agent and is located in the Disposal Area of Dunn Field. Beginning in May 2000, The entire target area was excavated, but neither CAIS nor PIGS were recovered. However, 24 jars labeled as "HS" (sulfur mustard) were recovered, but they were tested to be free of CWM. No CWM or CWM contaminated soil was found within the investigation area of Site 1. In August 2000, the removal action was complete at Site 1.

- Site 24-A –This site is the confirmed burial location for 29 bomb casings that were used to transport mustard agent from Germany to the U.S. after World War II and is located in the Disposal Area of Dunn Field. No mustard or other CWM was discovered at this

site; however, 900 cubic yards of soil contaminated with mustard degradation by-products were transported and disposed offsite. In November 2000, the removal action was complete at this site.

- Site 24-B -This site is the confirmed location of the neutralization pit for the contents of the 29 bomb casings and is located in the Stockpile Area of Dunn Field. Beginning in November 2000, 19 cubic yards of mustard contaminated soil and 14 cubic yards of soil contaminated with mustard degradation by-products were transported and disposed offsite. In March 2001, the removal action was complete at this site.

1.3.2.3 Remedial Investigation/Feasibility Study for Dunn Field

As part of the Depot's environmental cleanup program, an RI/FS has been conducted at Dunn Field. For the RI, historical records, historical aerial photographs, and employee interviews regarding burial or surface disposal areas and other areas of concern provided the basis for identifying locations to be investigated. During the 1980s and the early 1990s, groundwater monitoring wells were installed and groundwater, surface soil, and subsurface soil were sampled to determine the environmental impact of past activities at Dunn Field. In 1995, EPA and TDEC approved the *Final Generic Remedial Investigation/Feasibility Study Work Plan* (CH2M HILL, 1995c), which addressed application of the RI/FS process across the Depot. Also in 1995, the regulatory agencies approved the *Operable Unit 1 Field Sampling Plan (FSP)* (CH2M HILL, 1995e) to define specific sampling and characterization activities to be performed within Dunn Field. The goal of the 1995 FSP was to characterize the environmental impacts from past disposal practices and to identify and characterize specific disposal pits and trenches. Based on data collected as part of the ongoing RI, the IRA ROD was developed in 1996 for Dunn Field and early action was taken in 1998 to contain the spread of groundwater contamination in the fluvial aquifer from Dunn Field westward.

In 1998, additional information was gathered about the location of disposal areas and other areas of concern at Dunn Field. This information was developed from several sources, including results from geophysical investigations performed to locate metal objects and areas of disturbed soil performed by Parsons Engineering Science, Inc. (Parsons) to characterize suspected chemical warfare materiel (CWM) disposal areas, results of surface soil and groundwater sampling activities performed by OHM Remediation Services Corporation during installation of the groundwater extraction system at Dunn Field, and results from passive soil gas surveys conducted by CH2M HILL to identify areas where the soil has been impacted by vapors from volatile organic compounds (VOCs).

The RI report was originally submitted by CH2M HILL for review in March 2000. However, as a result of the potential detection of dense non-aqueous phase liquids (DNAPLs) in groundwater samples collected on March 14, 2000, from a monitoring well located near the western boundary of Dunn Field, the document was recalled. Addendum II to the RI/FS FSP was prepared for additional RI activities on the west-central portion of Dunn Field and areas immediately west (offsite) of Dunn Field (see Section 1.1.2 of the Dunn Field RI report).

CH2M HILL completed the Addendum II investigation in 2001, and the final RI report was submitted in July 2002 (CH2M HILL, July 2002).

The RI process at Dunn Field has provided sufficient information regarding the environmental impacts from former hazardous materials disposal activities to support selection of the final remedial actions for Dunn Field. The initial version Feasibility Study (FS) was submitted to the Memphis Depot BCT in August 2002 (CH2M HILL, August 2002). A groundwater VOC composite plume map from the FS is found as Figure 1-5. According to the Master Schedule for activities at the Memphis Depot, the final Dunn Field FS document is expected to be submitted in early 2003.

1.3.2.4 EE/CA for Site 60, Former Pistol Range

An EE/CA was performed by CH2M HILL in July 2002 to evaluate the recommended removal action for removing lead contaminated surface soil from the Site 60 - former Pistol Range in the Northeast Open Area on Dunn Field (Figure 1-3). This non-time critical early removal action will make the Northeast Open Area available for unrestricted future land use. Lead contamination in surface soil is the greatest potential concern to human health and the environment at Site 60.

The 30-day public comment period for the non-time critical removal action has been completed and the Action Memorandum for Site 60, including the Responsiveness Summary for all public comments received to date, was submitted as final on October 11, 2002. The removal action documented in the Action Memorandum is scheduled for implementation at Site 60 in the fall/winter of 2002 and early 2003.

1.3.2.5 Status of the MI

Since Dunn Field and the MI are part of the Memphis Depot and the actions on one site affect the decisions made on the other location, a status review of the MI was completed as part of this Five-Year Review.

The MI RI/FS has been conducted and the final reports are part of the Administrative Record. The results are discussed in the *Memphis Depot Main Installation Remedial Investigation Report* (CH2M HILL, January 2000), *Memphis Depot Main Installation Groundwater Feasibility Study Report* (CH2M HILL, July 2000), and *Memphis Depot Main Installation Soil Feasibility Study Report* (CH2M HILL, July 2000). The *Memphis Depot Main Installation Proposed Plan* (CH2M HILL, July 2000) was presented to the public in August 2000 and the *Memphis Depot Main Installation Record of Decision* (CH2M HILL, September 2001) was completed and signed by DLA and TDEC in February 2001. EPA signed the MI ROD in September 2001. The components of the selected remedy for the MI are as follows:

- Deed restrictions and site controls, which include the following:
  - Prevention of residential land use on the MI (except at the existing Housing Area [Parcel 2] and the main administration building [formerly known as Building 144] and adjacent parking areas [together known as Parcel 1]. The building and parking areas were transferred without restrictions as part of the acceptance of the September 2001 Finding of Suitability to Transfer (FOST) document).
  - Daycare restriction controls.
  - Production/consumptive use groundwater controls for the fluvial aquifer and for drilling into aquifers below the fluvial aquifer on the MI.

  - Elimination of casual access by adjacent off-site residents through maintenance of a boundary fence surrounding FU2 (golf course).

- Enhanced bioremediation of chlorinated volatile organic compounds (CVOCs) in the most contaminated part of the groundwater plume.
- Long-term groundwater monitoring to document changes in plume concentrations and to detect potential plume migration to off-site areas or into deeper aquifers.
- 5-year reviews of the selected alternatives.

The *Memphis Depot Main Installation Remedial Design Workplan* (CH2M HILL, July 2002) has been approved by EPA and TDEC, and the RD is currently underway at the MI. The final RD will be completed in 2003 and the Land Use Control Implementation Plan (LUCIP) will be included as part of the RD package for the MI. Currently, the land use controls identified in the MI ROD are in effect and are being monitored by the Depot personnel and their contractors (Jacobs). The last inspection verifying compliance of the land use controls at the MI was conducted in June 2002.

1.4 Description of the Remedial Actions

Since the Dunn Field FS has not been completed as of the date of this document, there are no proposed plans nor RODs in place that present selected remedial alternatives for the various media at Dunn Field. According to the Dunn Field FS, the media that will require remediation for protection of human health and the environment, based upon future uses, includes the disposal sites and associated subsurface soil, VOC-contaminated subsurface soil and soil-to-indoor air, and groundwater. Surface soils at Dunn Field are to be addressed with the removal action at Site 60. Groundwater was addressed as part of the Interim ROD (1996); however, as stated in Section 1.3.2.1, the IRA was not intended as a permanent solution, but it was intended to be compatible with the final remedy.

As stated in the document, the March 1996 Interim ROD for groundwater was developed because contaminated groundwater in the "Fluvial aquifer [underlying Dunn Field] poses a potential threat to the deeper Memphis Sand Aquifer, [and as a result] it is considered as a potential threat to human health and the environment". The IRA was intended to provide hydraulic control of the contaminant plume in groundwater. The major components of the selected IRA include the following:

- Evaluation of aquifer characteristics which may include installation of a pump test well
- Installation of additional monitoring wells to locate the western edge of the groundwater plume
- Installation of recovery wells along the leading edge of the plume
- Obtaining discharge permit for disposal of recovered groundwater to the T.E. Maxson Wastewater Treatment Plant publicly owned treatment works (POTW) or municipal sewer system
- Operation of the system of recovery wells until the risk associated with the contaminants is reduced to acceptable levels or until the final remedy is in place

- Chemical analysis will be conducted to monitor the quality of the discharge in accordance with the city discharge permit requirements; the permit will include parameters to be monitored and frequency.

The contaminants of concern for the fluvial aquifer, as described in the Interim ROD, included:

- Volatile Organic Compounds:

  Carbon Tetrachloride (CCl4)
  1,2-Dichloroethene (1,2-DCE)
  1,1,2,2-Tetrachloroethane (1,1,2,2-PCA)
  1,1-Dichloroethene (1,1-DCE)
  Tetrachloroethene (PCE)
  Trichloroethene (TCE)

- Metals:

  Arsenic
  Barium
  Chromium
  Lead
  Nickel

According to the Interim ROD, selection and implementation of the groundwater extraction system "initiates protection of human health under the exposure scenarios (provided in Section 2.6 of the Interim ROD) through mitigation of the spread of the plume and removing a portion of the contaminated groundwater until a final action is determined. The remedy also provides protection to the environment by providing the option of treatment of the extracted groundwater before discharge, and effective management of all residual wastes generated during implementation of the action." The final cleanup levels for groundwater were not addressed in the Interim ROD "because such goals are beyond the limited scope of this action". The IRA ROD stated further that the final cleanup goals are to be addressed in the final Dunn Field ROD.

1.5 ARARs Review

Section 121 (d)(2)(A) of CERCLA incorporates into law the CERCLA Compliance Policy, which specifies that remedial actions must meet any federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). Also included is the provision that state ARARs must be met if they are more stringent than federal requirements.

The ARARs identified and considered in the 1996 ROD for the IRA are chemical, action, and location specific and are found in Tables 4, 5, and 6 of that document. Primarily the ARARs were found to be applicable for certain actions, including Federal (i.e., 40 CFR 403.5 and 270.60, RCRA) and local discharge requirements to the POTW, discharge of pollutants to ambient air, applicability of an air stripping treatment system (as a contingency if pretreatment was needed), and cleanup levels for groundwater.

One of the purposes of the five-year review is to review federal and state requirements promulgated or modified after ROD signature to determine if they are applicable or relevant and appropriate and whether they are necessary to ensure protection of human health and the environment. Based on a review of the remedial objectives for the interim groundwater extraction system, the only action that would require ARARs is discharge to the POTW. As stated in the IRA ROD, the interim remedial action will not address groundwater cleanup ARARs. The levels of contaminants in the extraction system effluent discharged to the POTW is controlled by an Industrial Wastewater Discharge Agreement (or permit), as required by the City of Memphis Sewer Use Ordinance (March 1993). The Industrial Wastewater Discharge Agreement for discharge to the City of Memphis POTW was granted in 1998 and has been revised a number of times since then.

2.0 Site Conditions

2.1 Site Inspection Overview

A representative of CH2M HILL, with full knowledge and understanding by DLA, performed a site visit on Monday, September 16, 2002. The review consisted of a walk-through of the entire site, locating the interim groundwater extraction system, recovery wells, support buildings, and monitoring well network. The purpose of the visit was to observe current site conditions and to evaluate the effectiveness of the remedial actions performed to date. In addition, CH2M HILL met with personnel from the DLA and the USACE-Memphis District as part of the interview process and to get authority to enter and review Dunn Field. The DLA maintains personnel at the MI portion of the Memphis Depot on a full-time basis while the Memphis Depot is in transition from control by the DLA to the US Army.

2.2 Site Inspection Summary

This section presents information regarding observations made during the tour of Dunn Field by CH2M HILL. Appendix A contains photographs collected from Dunn Field during site visits in April and September, 2002. The following subsections described each of the facilities or characteristics of Dunn Field reviewed during site reconnaissance.

2.2.1 Initial Approach

Upon initial approach to the site, CH2M HILL noted that the area appeared to be well cared for, the fence surrounding the perimeter of the site was in excellent condition except for one area at a former railroad spur along the northern perimeter of the site, and all gates were locked with padlocks in the lock. The fence appears to have been damaged at some point in the past and part of the chain link fencing is bent away with a hole about 12-inches in diameter. The roads surrounding the site are maintained by the City of Memphis and all are in excellent condition. Paved roads on the interior of the site are also in excellent condition.

2.2.2 Site Topography and Grass Cover

During the site review, CH2M HILL noted that the grass cover over the site had been recently mowed, with most of the grass cover approximately 6 to 12 inches in length. Some areas, primarily along the fence and areas surrounding the groundwater extraction recovery well houses and control boxes, appeared to have grass that was higher than one foot. In some cases, trees and brush made it difficult to see the fence line. In general, however, it was apparent that an effort was made to control the growth of the grass cover. Also, it was noted that there are no areas where ground cover is absent or thin allowing surface runoff of soil to occur. CH2M HILL did not encounter any debris on the site as well.

Concrete pads are present on certain portions of the site (Appendix A). These were used as a base for bauxite and fluorspar mineral storage during active operations at Dunn Field. Also,

concrete ramps apparently used for truck or railroad boxcar loading and unloading were present at Dunn Field. Both the concrete pads and ramps were still in good condition.

Site topography is generally flat across the site except along the northern end of the site in the area known as the Northeast Open Area. This area is marked by a short rise in topography. Overall, Dunn Field has no open pits or relatively large surface depressions that may be remnants or indicators of past burial activity at the site, especially in the area known as the Disposal Area, which, as described in the Dunn Field RI, was used for disposal activities. Reportedly, all former disposal locations listed in Table 1-1 are still in place, except for those with known or suspected CWM contents, which were removed from the site by March 2001. Manmade ditches present in the Northeast Open Area and on the southwestern edge of the Disposal Area appeared to be without any constrictions allowing water to move freely off the site.

2.2.3 Groundwater Monitoring and Extraction Wells

There are a number of monitoring wells on Dunn Field. These were installed as part of various phases of the RI and O&M of the extraction system. The monitoring wells have a variety of surface completions, including stick-up well and flush-mount covers. Most of the wells were found in acceptable condition; however, several flush mounted wells are in need of new flush mounts and concrete pads. Several of these flush mounts are either missing a surrounding concrete pad or the concrete is severely broken. Table 2-1 presents a status review of all the wells associated with the Memphis Depot with designation for Dunn Field versus MI wells. Those recommended for immediate maintenance are highlighted in the table. Further discussion regarding schedule of maintenance for all wells located at Dunn Field is presented in Section 3.

Extraction wells are in good shape and the covers over them are in good shape as well. The lock mechanisms for each of the well covers are also in good shape.

Offsite monitoring wells were also reviewed and in general appear to be in good condition, but many of these wells also have poor surface completions. Many of the completions are overgrown with weeds and brush and the concrete surrounding the manhole is broken or missing.

2.2.4 Groundwater Extraction System

The Dunn Field groundwater extraction system is almost entirely underground except for the recovery or extraction wells and control panels. The extraction wells are housed in temperature controlled prefabricated buildings and the electrical panels controlling each well are housed in an adjacent separate building. Control buildings at all well locations appear to be in good condition.

The central control building for the extraction system is at the northern end of the site. This prefabricated building was locked and appeared in good condition.

2.2.5 Site Review Completion

After the field reconnaissance was complete, CH2M HILL departed the site to visit each of the Memphis Depot Information Repositories. These repositories are located at: (1) 2163 Airways Blvd., Building 144 of the Memphis Depot Business Park; (2) Memphis-Shelby

County Health Department, Jefferson Avenue; (3) Memphis-Shelby County Public Library (Cherokee Branch). Based on a review of the materials related to the Memphis Depot present at each repository, the repositories appear to be complete.

2.3 Review of Groundwater Sampling Data

Groundwater was sampled from a network of monitoring wells and the recovery/extraction wells on a quarterly basis for the first two years of operation of the interim groundwater extraction system. The reports for these were filed by OHM/IT until takeover of the system operation and maintenance by Jacobs in 1999 (under contract with the USACE-Mobile District). As of the third year of operations, beginning in 2001, the groundwater has been sampled semi-annually. In addition, groundwater recovered by the extraction system (total system effluent) has been sampled in compliance with the Industrial Wastewater Discharge Agreement with the City of Memphis.

Review of available data was completed by examining records available in the July 2002 RI report (CH2M HILL, July 2002) and the Semi-Annual Groundwater Quality Reports for Year Three, Second Half and Year Four, First Half (Jacobs, February and June 2002). These reports should be reviewed for more detailed discussion of the available groundwater data. The following information is based on analysis of individual wells within the current plume configuration (see the VOC composite plumes in Figure 1-5 and Figure 2-1 for well locations):

- Contaminants have not been detected in wells screened within the Memphis aquifer to date and only one detection of 1,1,2,2-PCA (9.6 ug/L) and TCE (1.0 ug/L) has occurred (in February 2001 in MW-43) in wells screened in the intermediate aquifer west of Dunn Field. The subsequent samples collected and analyzed from MW-43 have been non-detect for these VOCs.
- MW-33 is a control well on the southern edge of the plume and no chemicals of concern (COCs) have been detected in this well during the sampling events.
- MW-34 is located in the southwestern corner of Dunn Field and is screened within the intermediate aquifer. COCs have not been detected at concentrations exceeding MCLs during all sampling events, although chloroform concentrations appear to be slowly increasing at this location, from an average of 1.46 to 9.14 micrograms per liter (ug/L).
- Monitoring wells MW-42 and MW-80 are leading edge of plume sentinel wells and COCs have been non-existent in samples from these wells since samples were collected in February 2001.
- MW-78 is a northern plume edge sentinel well and has shown no COCs to date.
- Monitoring wells MW-70, -71, and -77, located offsite of Dunn Field along the western boundary, have been impacted significantly by site COCs and concentrations have tended to increase since data was collected for the RI.
- Monitoring well MW-79 is a leading edge of plume well west of Dunn Field and has shown increasing levels of contamination.

- Samples from MW-68, located near RW-08, have shown continuously decreasing levels of VOCs and, as of April 2002, contained only 1.01 ug/L of 1,1,2,2-PCA. The overall VOC contaminant concentrations in the area northwest of the NW corner of Dunn Field have decreased significantly. This decrease is attributed to the positive impacts of recovery well RW08 and RW-09 on the fluvial aquifer in that area.
- Offsite piezometer PZ-02 has shown concentrations of VOCs, but, based on the potentiometric surface maps in the July 2002 Dunn Field RI (Figures 14-51 and 14-52), this plume may be a result of an offsite source. The June 2002 *Offsite VOC Technical Memorandum* discusses this potential situation further.
- Monitoring wells MW-44 and MW-54, located west of Dunn Field, have shown continuously increasing levels of VOCs since samples were collected in these wells from November 2000. These wells appear to be located west of the influence of the interim groundwater extraction system.

2.4 Summary of Interviews

The Five-Year Review process requires that key individuals involved with the site be contacted for interviews. The interview process is intended to ascertain any new applicable information regarding the selected interim remedy, site history and other site-specific issues. It should be noted that this Five-Year Review is based on the implementation of an interim groundwater remedy and that the final Record of Decision for Dunn Field is scheduled for 2003. This ROD will include the selected remedy for all of Dunn Field. As part of this process, there has been an active involvement with Dunn Field on a daily to monthly basis by many of the key individuals associated with the project, including the remedial project managers with DLA, EPA, TDEC and the USACE, from 1998 through the date of this Five-Year Review. Therefore, information concerning Dunn Field has actively been disseminated to the key individuals involved with this site over the last five years.

Interviews for current and historical site information were conducted during and following the site visit. A CH2M HILL representative spoke with Mr. John De Back, BRAC Environmental Coordinator (BEC) with the Defense Logistics Agency (DLA). Mr. De Back was asked about the current status of Dunn Field. He stated that the RI for Dunn Field has been completed and the draft FS is currently being reviewed by the EPA and TDEC (as of the date of this report). Monthly effluent reports from the interim groundwater extraction system are filed by Jacobs Engineering DLA, EPA, TDEC and City of Memphis. Jacobs also completes semi-annual groundwater monitoring reports. These reports cover sampling and analysis of the 11 recovery wells and approximately 20 monitoring wells.

Mr. De Back stated that access to Dunn Field is restricted and limited to personnel from TDEC, EPA, Jacobs, CH2M HILL, USACE, MLGW, Depot Redevelopment Corporation (DRC) and City of Memphis. Access is primarily for grass mowing, O&M of recovery system, sample collection, and for meter reading (electrical and water). The Industrial Discharge Agreement requires meter reading and analysis of samples for the City of Memphis. Information goes to Mr. Akil Al-Chokhachi with the City of Memphis Division of Public Works.

Mr. De Back stated that the gates at Dunn Field are locked at all times. Mr. De Back added that the DRC conducts maintenance of the perimeter fencing under cooperative agreement with DLA. Currently, the fencing is intact. Although not written into a formal facility management plan, no intrusive activities at Dunn Field are permitted without DLA authorization. This is understood to be the case by the property owner and all that are permitted access. Mr. De Back also stated that all environmental field activities/events associated with Dunn Field are coordinated through Frontline Communications, which in turn prepare newsletters and fact sheets to notify the surrounding community members of such planned events.

Mr. De Back indicated that the key operation and maintenance activities of the interim groundwater extraction system have included expansion of the groundwater extraction system, periodic sampling and reporting, responding to electrical outages, pump motor failures and pump assembly replacements. All system operation and maintenance actions are documented in the monthly status reports that are submitted to DLA, EPA, TDEC and City of Memphis. Mr. De Back added that the operation of the interim groundwater extraction is fully funded through DLA and that the site is well maintained.

Mr. Kraig Smith, Project Manager with Jacobs was also interviewed. Jacobs is the Remedial Action (RA) contractor responsible for the O&M of the interim groundwater extraction system since 1999. Jacobs is under contract with the USACE, Mobile District. Mr. Smith was asked about the overall performance of the interim remedy. Mr. Smith stated that the remedy is serving to depress the piezometric surface of the fluvial aquifer and capture water flowing westward from the Dunn Field area and thus reduce the amount of impacted groundwater moving off-site. However, Mr. Smith added that evidence suggests that there is not 100 percent capture of westward flow, although the system is removing approximately 2 million gallons a month of groundwater and is also removing contaminant mass associated with the extracted groundwater.

Figures 2-2 and 2-3 are presented to highlight the areas of incomplete capture of the groundwater. Figure 2-2 presents a map of the potentiometric surface of the fluvial aquifer from November 1, 2001. Note that at recovery well RW-03 there is a topographic high indicating that groundwater was able to flow away and offsite from the extraction system. Figure 2-3 represents the potentiometric surface from May 2002. On this figure, several possible areas of incomplete capture of groundwater are discernable. The data on these figures reinforce the fact that there is not complete capture of westward flow by the extraction system.

Mr. Smith stated that the [system sample analytical] data indicates a slowly increasing trend in total concentration of contaminants (VOCs) in the water being discharged to the POTW. This has caused DLA to request a discharge limit increase in the Industrial Wastewater Discharge Agreement with the City of Memphis for several constituents. The likely cause of the increase was the addition of four new recovery wells to the system in 2001. Mr. Smith indicated that the monitoring well network when taken as a whole has not shown any significant upward or downward trends in contaminants; however, some individual wells such as MW-44, MW-54, MW-71 and MW-77 have shown an increasing trend in VOC concentrations.

Mr. Smith was asked if Jacobs provided a continuous presence at Dunn Field. He stated that there is not a continuous on-site presence for O&M; however, the system is monitored every few days by the use of a remote telemetry system. O&M is performed as necessary and as described in the Interim Remedial Action Operation and Maintenance Plan. Staff consists of site O&M manager from Jacobs, technician assistant from SEMS, Inc. and electrical and mechanical contractors as required. Site inspections are as follows:

- Remote Monitoring - Three times/week
- Monitoring Well Gauging - Bi-Weekly
- Well Inspections - Bi-Weekly
- Effluent Sampling - Quarterly
- Groundwater Sampling/Analysis - Semi-Annually
- System O&M/Recalibration - Semi-Annually

Mr. Smith was asked if there have been unexpected O&M difficulties or costs at the site since start-up or in the last 5-years. Mr. Smith stated that the primary unexpected O&M issues has been replacing pumps/motors in the recovery wells. Two pump replacements have already been performed in calendar year 2002 and one more may be required. This is considered unexpected because the operational life of the pumps/motors was expected to be longer. He added that the change to diffusion bag sampling rather than well purging has improved efficiency and decreased chance for sampling error. The increased analytical cost of additional samples has been offset by a reduction in the time necessary to perform the sample collection. Mr. Smith added that the cost of pulling/replacing pumps and motors could be significantly reduced by changing the system to a flexible hose drop-pipe. This would allow the pump/motor to be pulled by 2 or 3 workers using a hose reel and vehicle winch system. Since the interim system will remain in place until the final remedy is implemented, it may be advisable to replace the rigid drop pipes with flexible hose systems. A cost benefit analysis will have to be done to determine if this is the best way to proceed.

Mr. Greg Underberg with CH2M HILL was also interviewed. Mr. Underberg was the Project Manager with CH2M HILL from 1996 to 2000. CH2M HILL prepared the remedial design (1997) and the updated remedial design (2000) for the interim groundwater extraction system at Dunn Field. Mr. Underberg was asked about the history of the remedial design and its implementation. Mr. Underberg stated that CH2M HILL worked very closely with the USACE Waterways Engineering Station (WES) on the original and updated design. CH2M HILL designed the recovery wells, instrumentation and controls, piping and conveyance system details, etc. Mr. Underberg added that the recovery well placement and pumping rates for the interim groundwater extraction system were determined by WES through the use of a groundwater model called FEMWATER. This finite element flow model was used to determine the number and location of the groundwater recovery wells.

Mr. Underberg stated that the interim groundwater extraction system was to be installed in three phases: (1) installation of the initial seven recovery wells on Dunn Field; (2) installation of remaining recovery wells on Dunn Field; and (3) installation of offsite wells west of Dunn Field. The initial plan in 1997 identified that at the end of the first two phases, monitoring data would be reviewed and any changes would be made to the implementation of the Phase III. Mr. Underberg added that the concept of a phased approach grew out of two concerns: (1) the Depot's desire at the time (*circa* 1996-1997) to keep the initial wells

onsite; and (2) a dearth of data on the variability of the offsite hydrogeologic parameters and extent of groundwater contamination in the fluvial aquifer. WES modeled two phases - onsite wells only and offsite wells to capture the residual downgradient plume. System capture from the onsite wells would be used to model placement of the downgradient, offsite wells. In the initial design documentation, CH2M HILL discussed a Phase II (additional onsite wells along the perimeter of Dunn Field) and Phase III - offsite wells.

It should be noted that Phase I and II of the interim groundwater remedy were implemented at Dunn Field from 1998 through 2001. The remedial investigation was completed in 2001 and the RI report was finalized in July 2002. Delineation of the western extent of the groundwater contamination in the fluvial aquifer was completed in 2001. Phase III of the interim remedy (offsite recovery wells) was not implemented. Based on new information developed subsequent to the 1996 ROD, both from the RI and from implementation of the 1996 ROD, DLA, EPA, and TDEC agree that the offsite groundwater plume in the fluvial aquifer will be addressed in the final Proposed Plan and Record of Decision for Dunn Field in 2003. An explanation of significant differences to explain how the 1996 ROD was implemented in phases, and why it was not fully implemented, will be integrated into the final ROD.

3.0 Recommendations

3.1 Site Controls

According to information provided to CH2M HILL from Mr. John De Back of the DLA, the City of Memphis is responsible for the maintenance of the fencing surrounding the perimeter of Dunn Field. Although in general the fence appears to be in good condition, routine monitoring and maintenance should be performed at least once quarterly to ensure that gates are locked and padlocks are in place and that no holes or gaps have appeared in the fence. All inspection activities should be coordinated with onsite personnel of DLA or USACE (or their contractors).

Other site controls applicable to this site include the Rules and Regulations of Wells in Shelby County, which were promulgated by the Ground Water Quality Control Board for Shelby County, Tennessee. Under these rules, water wells are prohibited within one-half mile of the designated boundaries of a listed federal or state CERCLA site or RCRA corrective action site, unless the owner can demonstrate that movement of contaminated groundwater or materials into adjoining aquifers will not be enhanced by the well. In addition, these rules allow the Memphis-Shelby County Health Department to reject a permit application for a proposed well if the well will be harmful or potentially harmful to the water resources of Shelby County. The monitoring of these activities will be the responsibility of representatives of Memphis-Shelby County; however, representatives of the Memphis Depot should monitor the surrounding areas for possible industrial or residential well installation activities.

3.2 Groundwater Monitoring and Extraction Wells

Inspections of those onsite and offsite groundwater monitoring wells used for depth-to-water measurements should continue on a quarterly basis as long as the wells are used. Onsite or offsite monitoring wells that are not used for any continuous purpose should be inspected on a semi-annual basis until abandonment procedures are completed. All information gathered on the status of the monitoring wells at Dunn Field should be forwarded to DLA personnel for review and consideration. Decision on which wells to abandon will be made during design of the final remedy, which is scheduled for a ROD in calendar year 2003.

As shown on Table 2-1, a number of monitoring wells require immediate revitalization to ensure integrity of the wells and samples extracted from these wells. Table 2-2 presents a schedule of completion for this revitalization and the process for follow-up after future maintenance inspections. All renovations to monitoring wells should be completed by the end of the 1st quarter 2003. A report detailing the completion of this effort should be forwarded to the DLA for review and approval.

Future inspection efforts should include filing of a report to DLA after each event, noting any problems and a schedule of repair for the problems. These efforts should be followed up by procurement of a contractor by DLA to perform these activities thereby ensuring integrity of site wells and to ward off possible well intrusion. These problems may consist of broken or missing pads, missing manhole covers or bolts to hold the manhole covers down, missing well casing caps, and missing locks for the caps. Integrity of the well is essential to establish good geographical control over the contaminant plume. Long term operation and maintenance plans for groundwater monitoring should include maintenance and inspection of monitoring wells.

Extraction wells are currently inspected bi-weekly by Jacobs during monitoring episodes. These inspections should continue as long as the system is being maintained and used for groundwater extraction. Any problems encountered with the extraction well, pumps in the well, or electrical system should be remedied as soon as possible to maintain groundwater control. The current efforts by Jacobs to maintain the extraction system and ancillary equipment appears to be sufficient.

3.3 Groundwater and Effluent Sampling

Groundwater is currently sampled on a semi-annual basis from 26 monitoring wells and 11 extraction wells. These monitoring events appear sufficient to provide enough data to map the contaminant plume configuration and should continue in this manner until the final remedy is selected and implemented.

CH2M HILL conducted a review of the historical sampling data from wells that are part of the monitoring system to define if there are wells that should be dropped from or added to the list of wells to be monitored. CH2M HILL recommends that wells MW-30 and MW-95 be removed from monitoring because groundwater samples from those locations have not revealed any contaminants since inception of sampling and there are monitoring wells located between these wells and the edge of the contaminant plume that will provide the required information. In addition, CH2M HILL recommends that two newly installed wells (MW-126 and MW-127), PZ-02, and MW-29 should be added to the list of wells to be monitored. The two new wells are located on the western fringe of the plume and can define westward migration of the plume. PZ-02 is upgradient of Dunn Field but is also located in the center of what is reported to be a plume emanating from an offsite source. MW-29 is in the northeastern corner of Dunn Field and is upgradient of most of the groundwater plumes emanating from Dunn Field (as shown in the July 2002 Dunn Field RI), but is also located in the same plume as PZ-02. Sampling of this well would help refine the theory of an offsite source and the tracking of the plume emanating from that source. Review of those wells pertinent to the monitoring of the contaminant plume should be completed bi-annually until the final remedy for groundwater is selected.

Groundwater sampling for the monitoring system has been recently switched to use of polyethylene diffusion bags (PDBs). These PDB samplers have decreased the waste and effort typically required for groundwater sampling and have provided consistent results while permitting a view of the contaminant stratification in each well screen. The continued use of the PDB samplers is encouraged. As has been the practice for Memphis Depot, the data resulting from PDB samplers should be averaged per well. Groundwater sample VOC

data collected via PDBs for the 2001 LTOA Investigation and the Dunn Field RI report were reported as an average across the screened section of each well. However, the data available to readers should also include the results of VOCs for each sample collected from the sampling event.

Effluent samples are now collected on a quarterly basis for VOCs. Samples are collected on an annual basis for semi-volatile organic compounds (SVOCs) and metals. Based on a review of the data, this sample collection frequency appears to be adequate. As noted in the June 2002 Semi-Annual Groundwater Quality Report (Year Four, First Half), chloroform and cis-1,2-dichloroethene (cis-1,2-DCE) exceeded discharge limits during the monitoring period. A request to revise the chloroform monthly average and one-time maximum and the cis-1,2-DCE monthly average discharge limits was made by Mr. Clyde Hunt, the Remedial Project Manager for the Memphis Depot from USACE-Memphis District. The revision to the limits was approved by the City of Memphis Division of Public Works on June 4, 2002 (Appendix B).

3.4 Groundwater Extraction System

Operation and maintenance (O&M) of the groundwater extraction system is performed in two ways: The system is monitored by telemetric methods three times a week, bi-weekly site visits, and semi-annual system O&M and recalibration is performed. Jacobs has recently proposed that the site visits should be performed on a monthly basis because the system is operating efficiently, the telemetric system is in place, and the bi-weekly visits are not an efficient use of time. In addition, Jacobs has also proposed that the O&M and recalibration be changed to an annual event because one event per year will be sufficient for this activity. The current O&M schedule and recommended changes appear to be sufficient to maintain the system until the final remedy for the site is in place.

As presented in the July 2002 Dunn Field RI, and the Semi-Annual Groundwater Quality Report for Year Three, Second Half (Jacobs, February 2002) and Year Four, First Half (Jacobs, June 2002), the extraction system does not appear to perform as efficiently as possible to capture the contaminated groundwater as the groundwater flows westward from Dunn Field. The following statement is quoted from the RI report:

> "Potentiometric surface contours suggest groundwater is captured in the immediate vicinity of each recovery well. However, capture zones are not completely connected between RW-01 to RW-1A, RW-02 to RW-03, RW-03 to RW-04, RW-04 to RW-05, and RW-06 to RW-07. Therefore, areas between these recovery wells could allow contaminates to pass through the recovery system."

Semi-Annual Groundwater Quality Reports have also indicated that their has been an increase in concentration of the VOCs TCE, carbon tetrachloride, chloroform, and 1,1,2,2-PCA in samples from monitoring wells MW-32, -54, and -71. Based on potentiometric surface maps presented as Figures 14-51 and 14-52 in the July 2002 Dunn Field RI, groundwater flows to the northwest directly from Dunn Field westward through each of these wells, with MW-71 being the closest to the perimeter of Dunn Field. This information indicates that there is some degree of incomplete plume capture.

Based on this information, it is recommended that the system be optimized as much as possible by maintaining the pumps and transducers that monitor water levels and trigger the pumping action. Without efficient pumping action, the groundwater and contaminants contained therein will continue to migrate westward. Since the final remedy is expected to be selected by summer of 2003, there does not appear to be a need to install additional extraction wells and add these to the existing system, especially since the process may require approximately 8-12 months to complete. Continued O&M and optimization of the existing system should be sufficient to control groundwater until the final remedy is selected and implemented.

Table 3-1 presents the installation and O&M costs for the groundwater extraction system at Dunn Field. O&M costs include pump and well maintenance, sampling and monitoring efforts, monitoring well maintenance, and effluent disposal. Additional capital costs were necessary during the end of the first year of maintenance to install four additional recovery wells (Phase II of the interim remedy) at the southern end of the extraction line.

3.5 Statement of Protectiveness

According to the March 1996 Interim ROD document, the principal goals of the IRA are to incrementally remove contaminants from the fluvial aquifer, to decrease risk by mitigating the spread of constituents toward the Allen Well Field, and to create a hydraulic barrier to prevent contamination in the fluvial aquifer at Dunn Field from reaching the Allen Well Field (approximately one-half mile west of Dunn Field). The document added that: "Although the IRA is not anticipated to achieve compliance with MCLs, it is consistent with the objective to protect the Memphis Sand Aquifer. Long-term operation of a groundwater removal system will help to achieve MCLs by incrementally removing contaminants."

While over 300 pounds of VOCs have been removed from groundwater by the IRA, the extraction system does not provide complete control over groundwater flow and the spread of contaminant constituents in the fluvial aquifer from the western perimeter of Dunn Field. As a result, and as noted in Section 3.4 of this five-year review, contaminant levels have been increasing in a few monitoring wells downgradient and offsite of Dunn Field. Since the extraction system has not completely contained the spread of contaminants toward the Allen Well Field, the remedy does not fully satisfy the principal IRA goals and can only be considered protective in the short term. The only goal that is being met by the remedy is incremental removal of contaminants. However, because there is no current use of, nor plan to use, the shallow groundwater as a drinking water supply, and because local ordinances restrict installation of private wells, the IRA is considered protective in the short term.

One factor that has affected the protectiveness of the system is that one of the major components of the selected IRA was not implemented. The installation of recovery wells along the "leading edge of the plume" was never completed (known as Phase III); only on-site recovery wells were installed (Phases I and II). The decision to not install wells along the leading edge is reportedly based upon the following:

- The leading edge of the plume had not been delineated as the RI had only just begun, but additional extraction wells were to be installed once the leading edge was defined. The western edge of the plume was defined in 2001. During 1997 and 1998, the BCT

reviewed the IRA designs and found the initial well locations to be adequate for the purpose of implementing Phase 1of the remedy.

- Data gathered during phases I and II of the interim remedy, and during the RI, strongly suggested that aquifer restoration could be accomplished more effectively by means other than expanding the groundwater extraction system as a final remedy. Changes to the interim ROD will be documented as an explanation of significant differences in the final ROD.

A fully protective remedy for all media will be selected in the final ROD for Dunn Field, which is expected to be completed before the end of FY 2003.

3.6 Next Review

The next five-year review will be completed within 5 years of EPA's concurrence date on this review. It is anticipated that the next review will incorporate the final remedies for both Dunn Field and the Main Installation, and all subsequent five-year reviews will evaluate the entire NPL site.

3.7 Implementation Requirements

To continue the groundwater monitoring and the extraction system, monitoring well, and extraction well O&M, as described in Table 2-2, as well as to install the offsite contamination wells to the northeast of Dunn Field, the DLA should continue to fund these activities at the present level and supply non-emergency funds for items outside of regular O&M activities. In addition, DLA and the USACE must continue to maintain agreements with the City of Memphis and others that will be monitoring site controls and the grass cover at Dunn Field.

4.0 References

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TABLE 1-1
List of Dunn Field (OU 1) Sites
Rev. 1 Dunn Field Five-Year Review

INSTALLATION RESTORATION SITES NUMBER	DSERTS SITE NUMBER[a]	PRIORITY LEVEL[b]	SITE TYPE	SITE DESCRIPTION
Northeast Open Area				
19	19	C	SS	Former Tear Gas Canister Burn Site [c]
20	20	C	SS	Probable Asphalt Burial Site
21	21	C	SS	XXCC-3 Impregnite Burial Site (300,000 Pounds)
50	50	C	SS	Dunn Field Northeastern Quadrant Drainage Ditch
60	60	RA Planned[1]	SS	Pistol Range Impact Area/Bullet Stop
62	62	C	SS	Bauxite Storage
85	85	RA Planned[1]	RI	Old Pistol Range Building 1184/Temporary Pesticide Storage
Disposal Area				
1	1	Remediated[2]	CWM	Mustard and Lewisite Training Sets Burial Site (1955)
2	2	C	RI	Ammonia Hydroxide (7 Pounds) and Acetic Acid (1-Gallon) Burial Site (1955)
3	3	B	RI	Mixed Chemical Burial Site (Orthotouidine Dihydrochloride) (1955)
4	4	A	RI	POL Burial Site (13, 55-Gallon Drums of Oil, Grease and Paint)
4.1	90	A	RI	POL Burial Site (32, 55-Gallon Drums of Oil, Grease and Thinner)
5	5	C	RI	Methyl Bromide Burial Site A (3 Cubic Feet) (1955)
6	6	C	RI	40,037 Units of Eye Ointment Burial Site (1955)
7	7	A	RI	Nitric Acid Burial Site (1,700 Quart Bottles) (1954)
8	8	A	RI	Methyl Bromide Burial Site B (3,768 1-gallon cans) (1954)
9	9	C	RI	Ashes and Metal Burial Site (Burning Pit Refuse) (1955)
10	10	B	RI	Solid Waste Burial Site (Near MW-10) (Metal, Glass, Trash, etc.)
11	11	B	RI	Trichloroacetic Acid Burial Site (1,433, 1-ounce Bottles) (1965)
12 & 12.1	12	B	RI	Sulfuric Acid and Hydrochloric Acid Burial (1967)
13	13	A	RI	Mixed Chemical Burial (Acid, 900 Pounds; Unnamed Solids, 8,100 Pounds)
14	14	C	RI	Municipal Waste Burial Site B (Near MW-12) (Food, Paper Products)
15	15	B	RI	Sodium Burial Sites (1968)
15.1	91	B	RI	Sodium Phosphate Burial (1968)
15.2	92	B	RI	14 Burial Pits: Na2PO4, Sodium, Acid, Medical Supplies, and Chlorinated Lime
16	16	B	RI	Unknown Acid Burial Site (1969)
16.1	93	B	RI	Acid Burial Site
17	17	B	RI	Mixed Chemical Burial Site C (1969)
18	18	C	Proposed NFA	Plane Crash Residue
22	22	C	Proposed NFA	Hardware Burial Site (Nuts and Bolts)
23	23	C	Proposed NFA	Construction Debris and Food Burial Site
24-A	24	Remediated[2]	CWM	Bomb Casing Burial Site (29 Bomb Casings used to Transport Mustard Agent)
61	61	C	SS	Buried Drain Pipe
63	63	C	Proposed NFA	Aboveground Fluorspar Storage
64	64	C	Proposed NFA	Aboveground Bauxite Storage (1942 to 1972)
86	86	C	RI	Food Supplies
Stockpile Area [d]				
24-B	24	Remediated[2]	CWM	Neutralization Pit for the Contents of the 29 Bomb Casing used to Transport Mustard Agent
62	62	C	SS	Aboveground Bauxite Storage
63	63	C	Proposed NFA	Aboveground Fluorspar Storage
64	64	C	SS	Aboveground Bauxite Storage (1949 to 1972)
--	--	B	--	CC-2 Impregnite Burial Site (86,100 Pounds in 1947)

Notes:

[1] See EE/CA and Action Memorandum for Site 60/85. Removal planned for early 2003.

[2] CWM remedial actions at sites are documented in the Final Chemical Warfare Materiel Investigation/Removal Action Report, dated December 2001.

SS:	Screening Site
RI:	Remedial Investigation
RA:	Remedial Action
NFA:	No Further Action
CWM:	Chemical Warfare Materiel
Na2PO4:	Sodium Phosphate
POL:	Petroleum, Oil, and Lubricants
XXCC-3/CC-2:	Stabilized/Unstabilized Impregnite for Impregnating Clothing Used to Protect Personnel against the Action of Vesicant-Type Chemical Agents

[a] Defense Site Environmental Restoration Tracking System (DoD Database)

[b] Priority levels were established for Installation Restoration Sites Number/DSERT Site Number Areas where remedial action will be required with some investigatory effort to determine extent of area. Levels are as follows: A - Highest Priority; B - Medium Priority; C - Lowest Priority (no RA likely). Designation is based on described quantity of material, potential hazard to human health and the environment, and form of material (solid or liquid).

[c] According to the available information, burning in this area dated back to the 1940s and included chloroacetophenone (CN) canisters, fuses, and smokes, in addition to sanitary wastes. Operations were conducted in pits and incorporated the weekly cleanup of residue and garbage in addition to material. The ash was then allegedly buried in the north end of Dunn Field.

[d] According to available information, USATHAMA (1982) Installation Assessment Site 31 is located in the southwest portion of Dunn Field. This site was reportedly used for burning/disposal of smoke pots, CN (tear gas) grenades and souvenir ordnance, which included a 3.2 mortar round. This area was covered by the bauxite storage pile (Site 64). Installation Site 31 was not designated as an IRP site or given a DSERTS site number.

Table 2-1

Status Review of Monitoring, Injection, and Recovery Wells, and Piezometers for Entire Memphis Depot Area

Rev. 1 Dunn Field Five Year Review

Well Identification	Location - Dunn Field (DF) or Main Installation (MI)	On- or Offsite	Status of Monitoring Well Surface Completion	Maintenance Required Immediately* (Yes or No)
Monitoring Wells:				
MW-02	DF	On		
MW-03	DF	On	needs padlock	Yes
MW-04	DF	On		
MW-05	DF	On	missing well cap; need padlock	Yes
MW-06	DF	On	no concrete pad, no manhole cover, has metal pipe approximately 4 inches above ground surface with well inside	Yes
MW-07	DF	On		
MW-08	DF	On	no visible concrete pad, manhole cover below ground surface; need padlock	Yes
MW-09	DF	On	no visible concrete pad, manhole cover below ground surface	Yes
MW-10	DF	On		
MW-11	DF	On	manhole cover below ground surface; need padlock	Yes
MW-12	DF	On	no visible concrete pad, manhole cover below ground surface	Yes
MW-13	DF	On	no visible concrete pad, manhole cover above ground surface; needs new transducer collar	Yes
MW-14	DF	On	no visible concrete pad, no manhole cover	Yes
MW-15	DF	On	no visible concrete pad, manhole cover below ground surface; need padlock	Yes
MW-16	MI	On	no visible concrete pad, manhole cover below ground surface	Yes
MW-17	MI	On	dry well, abandon	No
MW-18	MI	On		
MW-19	MI	On		
MW-20	MI	On	no visible concrete pad, manhole cover below ground surface	Yes
MW-21	MI	On	cracked concrete pad, below ground surface	No
MW-22	MI	On	no visible concrete pad, manhole cover below ground surface	Yes
MW-23	MI	On	no visible concrete pad, manhole cover below ground surface	Yes
MW-24	MI	On	no visible concrete pad, manhole cover below ground surface	Yes
MW-25	MI	On		
MW-26	MI	On		
MW-27	MI	On	dry well, abandon / concrete pad fine	No
MW-28	DF	On	no bolts on lid	Yes
MW-29	DF	On	no visible concrete pad, manhole cover below ground surface	Yes
MW-30	DF	Off (N)	need padlock	Yes
MW-31	DF	Off (NW)		
MW-32	DF	Off (W)	missing 2 bolts from lid	No
MW-33	DF	Off (W)		
MW-34	MI/DF	On DF	missing 2 bolts from lid	No
MW-35	DF	On	no visible concrete pad, manhole cover below ground surface	Yes
MW-36	MI/DF	On DF	no visible concrete pad, manhole cover below ground surface; missing 2 bolts	Yes

Table 2-1

Status Review of Monitoring, Injection, and Recovery Wells, and Piezometers for Entire Memphis Depot Area

Rev. 1 Dunn Field Five Year Review

Well Identification	Location - Dunn Field (DF) or Main Installation (MI)	On- or Offsite	Status of Monitoring Well Surface Completion	Maintenance Required Immediately* (Yes or No)
MW-37	DF	Off (W)		
MW-38	MI	On		
MW-39	MI	On	could not locate well due to sediment deposition and construction	Yes
MW-40	DF	Off (NW)		
MW-41	MI/DF	Off (W)		
MW-42	DF	Off (W)	needs new concrete pad and manhole cover plus lock	Yes
MW-43	DF	Off (W)		
MW-44	DF	Off (W)	fine but very small manhole cover	No
MW-45	DF	Off (E)		
MW-46	DF	On	small manhole cover, below ground surface	Yes
MW-47	MI	Off (S)		
MW-48	MI	Off (W)	no well casing visible, needs to be abandoned	No
MW-49	DF	On	no manhole cover, old concrete below ground surface; needs new well pad	Yes
MW-50	MI	On	needs new concrete pad, manhole cover, and well cap plus lock	Yes
MW-51	DF	Off (N)	could not locate well due to vegetation and sediment deposition	Yes
MW-52	MI	On	need new concrete pad, loose and cracked	No
MW-53	MI	Off (N)	possibly needs concrete pad and manhole cover replaced; cannot lock well	Yes
MW-54	DF	Off (W)	no manhole cover and concrete is brittle and cracked	Yes
MW-55	MI/DF	On MI		
MW-56	DF	On	missing 1 ballard, knocked down; missing 1 bolt	No
MW-57	DF	On	no bolts on lid	Yes
MW-58	DF	On	missing 1 bolt from lid	No
MW-59	DF	On	missing 1 bolt from lid	No
MW-60	DF	On	no bolts on lid	Yes
MW-61	DF	On		
MW-62	MI	On		
MW-63	MI	On		
MW-64	MI	On		
MW-65	DF	Off (N)		
MW-66	MI	Off (W)		
MW-67	DF	Off (W)	missing 1 bolt from lid	No
MW-68	DF	Off (W)	missing 2 bolts and padlock	Yes
MW-69	DF	Off (W)		
MW-70	DF	Off (W)		
MW-71	DF	Off (W)		
MW-72	MI	Off (SW)		
MW-73	DF	On	missing 1 bolt from lid	No
MW-74	DF	On		
MW-75	DF	On		
MW-76	DF	Off (W)	missing 2 bolts and padlock	Yes
MW-77	DF	Off (W)	missing padlock	Yes

Table 2-1

Status Review of Monitoring, Injection, and Recovery Wells, and Piezometers for Entire Memphis Depot Area

Rev. 1 Dunn Field Five Year Review

Well Identification	Location - Dunn Field (DF) or Main Installation (MI)	On- or Offsite	Status of Monitoring Well Surface Completion	Maintenance Required Immediately* (Yes or No)
MW-78	DF	Off (N)	missing padlock	Yes
MW-79	DF	Off (W)	missing padlock	Yes
MW-80	DF	Off (W)	missing padlock	Yes
MW-81	MI	On		
MW-82	MI	On		
MW-83	MI	On	pad not cracked but rough concrete	No
MW-84	MI/DF	On DF		
MW-85	MI	On		
MW-86	MI	On		
MW-87	DF	On	missing padlock	Yes
MW-88	MI	On		
MW-89	MI	On	concrete pad cracked; missing padlock	Yes
MW-90	MI	On	missing padlock	Yes
MW-91	DF	On	missing padlock	Yes
MW-92	MI	On		
MW-93	MI	On		
MW-94	MI	On	concrete pad is fine, construction activities occurred next to well, soil removed from around pad and two ballards removed	No
MW-95	DF	Off (N)	missing padlock; needs new pressure transducer lid	Yes
MW-96	MI	On		
MW-97	MI	On		
MW-98	MI	On		
MW-99	MI	On		
MW-100	MI	On	casing warped during grout curing processes, need to abandon well	No
MW-100B	MI	On		
MW-101	MI	On		
MW-102	MI	On	casing warped during grout curing processes, need to abandon well	No
MW-102B	MI	On		
MW-103	MI	On		
MW-104	MI	On		
MW-105	MI	On		
MW-106	MI	On		
MW-107	MI	On		
MW-108	MI	On		
MW-109	MI	On		
MW-110	MI	On		
MW-111	MI	On		
MW-112	MI	On		
MW-113	MI	On		
MW-114	MI	On		
MW-115	MI	On		
MW-116	MI	On		
MW-117	MI	On		
MW-118	MI	On		
MW-119	MI	On		
MW-120	MI	On		
MW-121	MI	On		
MW-122	MI	On		
MW-123	MI	On		
MW-124	MI	On		
MW-125	MI	On		

Table 2-1

Status Review of Monitoring, Injection, and Recovery Wells, and Piezometers for Entire Memphis Depot Area

Rev. 1 Dunn Field Five Year Review

Well Identification	Location - Dunn Field (DF) or Main Installation (MI)	On- or Offsite	Status of Monitoring Well Surface Completion	Maintenance Required Immediately* (Yes or No)
Piezometers:				
PZ-01	MI	Off (S)		
PZ-02	DF	Off (N)		
PZ-03	MI	On		
PZ-04	MI	Off (SW)		
PZ-05	MI	Off (S)		
PZ-06	MI	On		
PZ-07	MI	On		
PZ-08	MI	Off (S)	cannot locate piezometer; appears a telephone pole marked "Locate Pole" is in the same location	Yes
Injection Wells:				
IW-1	MI	On		
IW-2	MI	On		
IW-3	MI	On		
IW-4	MI	On		
IW-5	MI	On		
IW-6	MI	On		
IW-7	MI	On		
Recovery Wells:				
RW-01	DF	On		
RW-01A	DF	On		
RW-01B	DF	On		
RW-02	DF	On		
RW-03	DF	On		
RW-04	DF	On		
RW-05	DF	On		
RW-06	DF	On		
RW-07	DF	On		
RW-08	DF	On		
RW-09	DF	On		

NOTES:

If no status is provided, then the well is considered to be in good condition and is protective.

MW = monitoring well

RW = recovery well

PZ = peizometer

HY = hydropunch locations

STB = soil test boring

MP = SVE monitoring point

VW = SVE venting well

*Maintenance needs only applied to those wells with status less than good condition

Table 2-2
Recommendations and Follow-Up actions for Issues at Dunn Field
Rev. 1 Dunn Field Five-Year Review

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Monitoring Well Retrofitting at Dunn Field*	Complete repairs to protect integrity of wells and samples achieved from each well; Follow-up action includes procurement of contractor to complete repair activities at each well. Table 2-1 provides information on each monitoring well. This action should be followed by a report detailing activities accomplished at each well and forwarded to DLA for review and approval.	Defense Logistics Agency (DLA)	TDEC; EPA	Complete by end of 1st quarter 2003.	Y	Y
Groundwater Monitoring and Monitoring Well Wellhead Inspections	Continue inspections of monitoring wells at and offsite of Dunn Field as part of routine groundwater level monitoring efforts. Each inspection activity should be followed by a report detailing activities completed at each well and forwarded to DLA for review and approval.	DLA	TDEC; EPA	Maintain on a quarterly basis	Y	Y
Piezometers at or offsite from Dunn Field	Continue inspections of piezometers at and offsite of Dunn Field as part of routine groundwater level monitoring efforts. Each inspection activity should be followed by a report detailing activities completed at each well and forwarded to DLA for review and approval.	DLA	TDEC; EPA	Semi-annual basis	N	Y
Extraction System-Recovery Well Wellhead Inspections	Continue inspections of recovery wells at Dunn Field as part of routine groundwater level monitoring efforts. Inspection report should be filed with monthly Effluent and Operations Reports for DLA review and approval. Any repair needs for the recovery wells and well houses should completed as soon as possible to prevent possible intrusion.	DLA	TDEC; EPA	Maintain on a bi-weekly basis	Y	Y

Table 2-2
Recommendations and Follow-Up actions for Issues at Dunn Field
Rev. 1 Dunn Field Five-Year Review

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Extraction System Maintenance	Continue inspections of extraction system at Dunn Field as part of routine groundwater level monitoring efforts. Inspection report should be filed with monthly Effluent and Operations Reports for DLA review and approval.	DLA	TDEC; EPA	Maintain current inspection schedule until switch to a monthly basis; Maintain semi-annual basis until annual visits begin for system O&M and recalibration.	Y	Y
Extraction System/Groundwater Sampling - Monitoring System	Sampling efforts should be continued at current rate to ensure efficiency and protectiveness of system. Reporting of results should be continued at current rate and forwarded to DLA for review and approval.	DLA	TDEC; EPA	Semi-annual basis	Y	Y
Extraction System - Effluent Sampling	Effluent sampling should continue at current rate to ensure compliance with discharge permits. Reporting of results should be continued at current rate and forwarded to DLA for review and approval.	DLA	TDEC; EPA; City of Memphis	Quarterly basis	N	N
Offsite Monitoring Wells	Continue with installation of offsite monitoring wells to the northeast of Dunn Field to define offsite groundwater contaminant plume source and location. Reporting of well installation and sampling results should be forwarded to DLA for review and approval.	DLA	TDEC; EPA; City of Memphis	Quarterly basis	N	N

*Table 2-1 presents information on wells and piezometers associated with the entire Memphis Depot. Only those that are associated with Dunn Field are included in this Five-Year Review document; however, all wells and piezometers at Memphis Depot should be included in the procurement of a contractor to ensure integrity of the entire site.

TDEC = Tennessee Department of Environment and Conservation

EPA = US Enviromental Protection Agency

Table 3-1
Remedial Action Construction/O&M Costs
Rev. 1 Dunn Field Five-Year Review

Event	Dates		Total Cost ($)
	From	To	
Phase I RA Construction	September 23, 1997	November 3, 1998	2,247,300
System O&M (Year 1)	November 4, 1998	November 3, 1999	288,500
System O&M (Year 2)	November 4, 1999	January 31, 2001	235,000
Phase II RA Construction	August 9, 1999	September 7, 2001	894,800
System O&M (Year 3)	February 1, 2001	December 31, 2001	183,500
System O&M (Year 4)	January 1, 2002	December 31, 2002	216,300
		TOTAL:	**4,065,400**

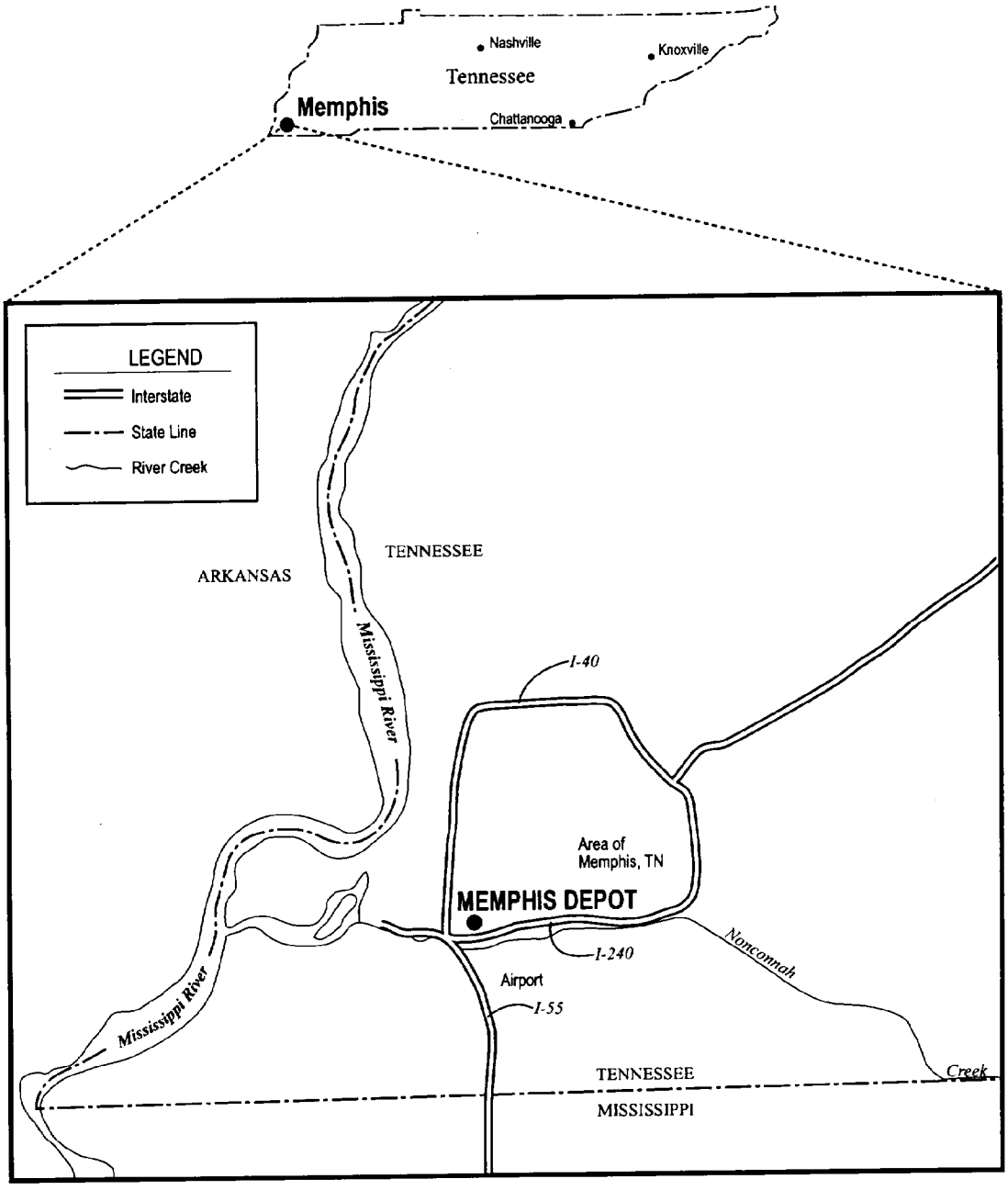
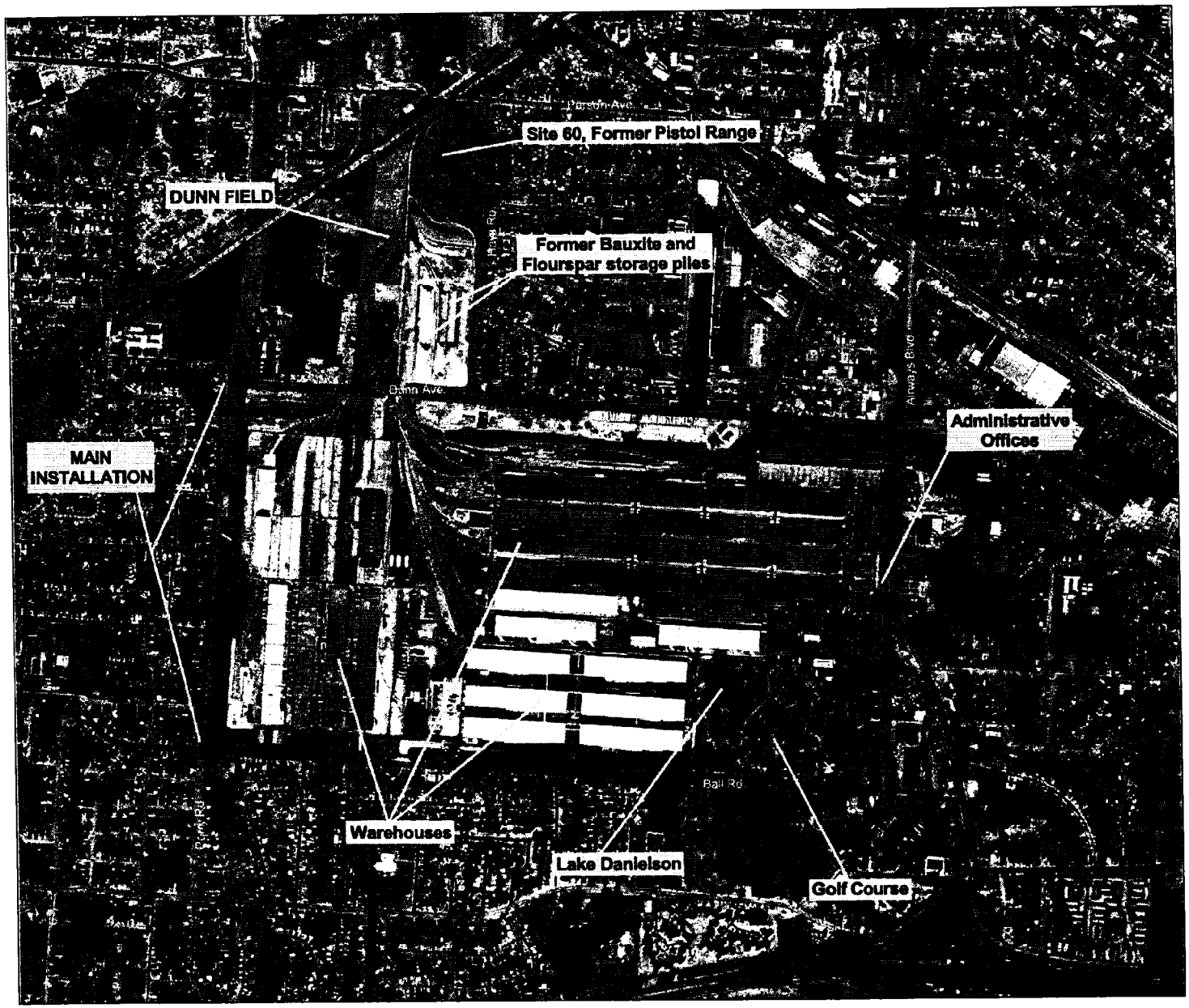


FIGURE 1-1
MEMPHIS DEPOT LOCATION IN THE MEMPHIS METROPOLITAN AREA
REV. 0 DUNN FIELD - FIVE-YEAR REVIEW



N

LEGEND

Site Boundary

0 500 1000 Feet

SCALE IS APPROXIMATE

Figure 1-2
MAJOR FEATURES OF THE DEPOT
Aerial Photo Date: 1997
Rev. 0 Dunn Field - Five-Year Review

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ATL \\Ecomm\Projects3\Memphis\gis\rvd\dunnfield_aerial.apr

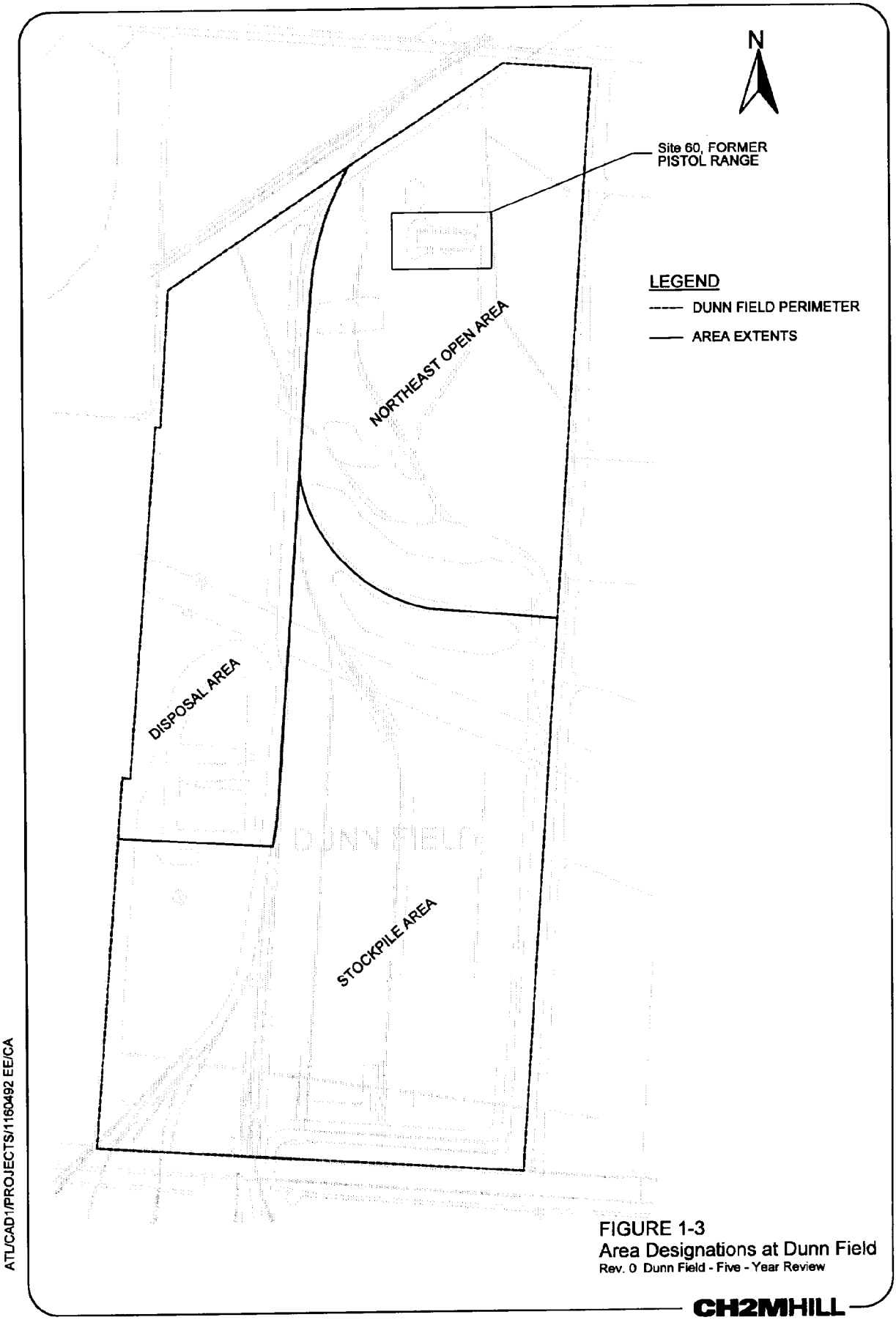

FIGURE 1-3
Area Designations at Dunn Field
Rev. 0 Dunn Field - Five - Year Review

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ATL/CAD1/PROJECTS/1160492 EE/CA

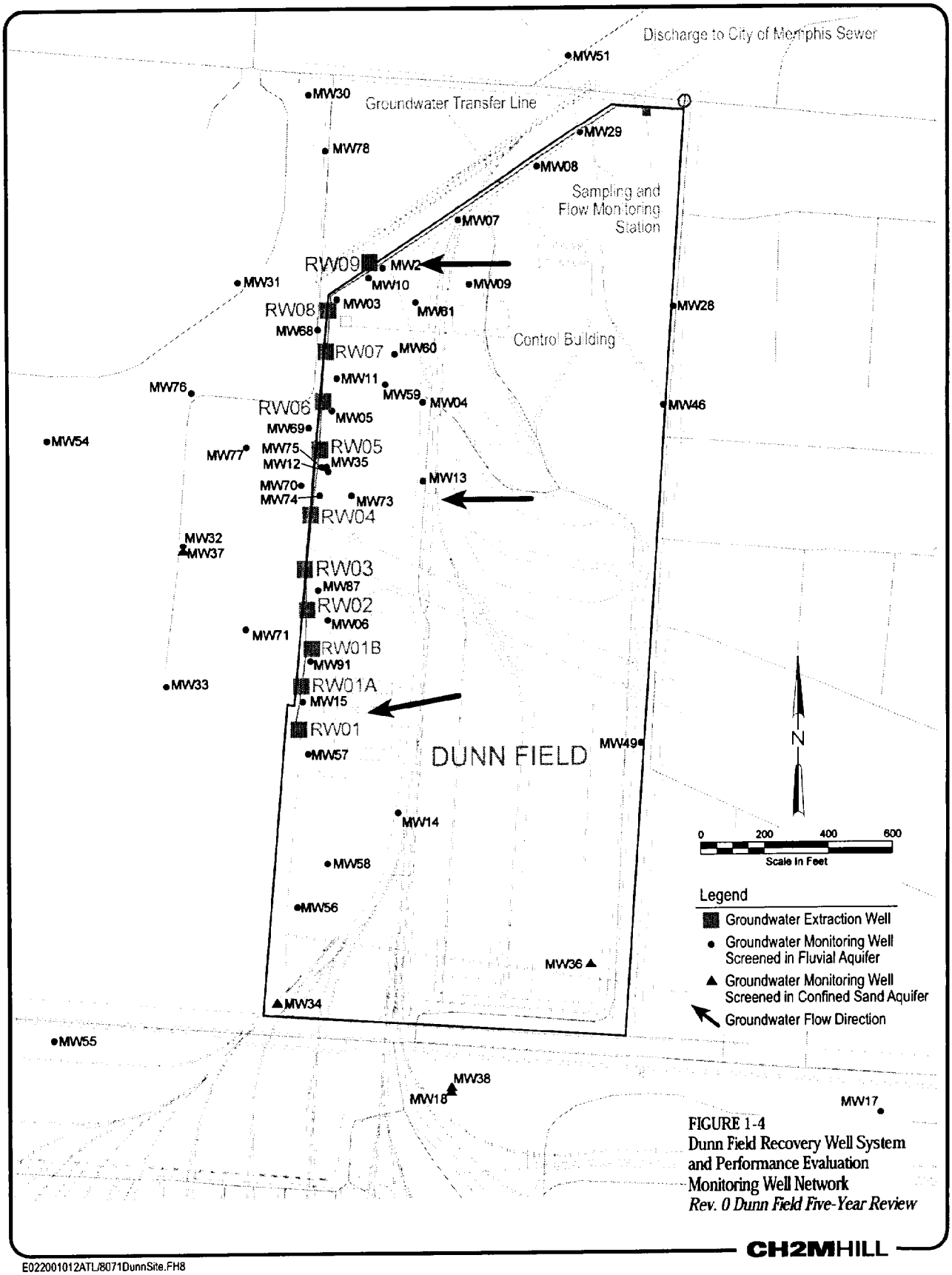

FIGURE 1-4
Dunn Field Recovery Well System and Performance Evaluation Monitoring Well Network
Rev. 0 Dunn Field Five-Year Review

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E022001012ATL/8071DunnSite.FH8

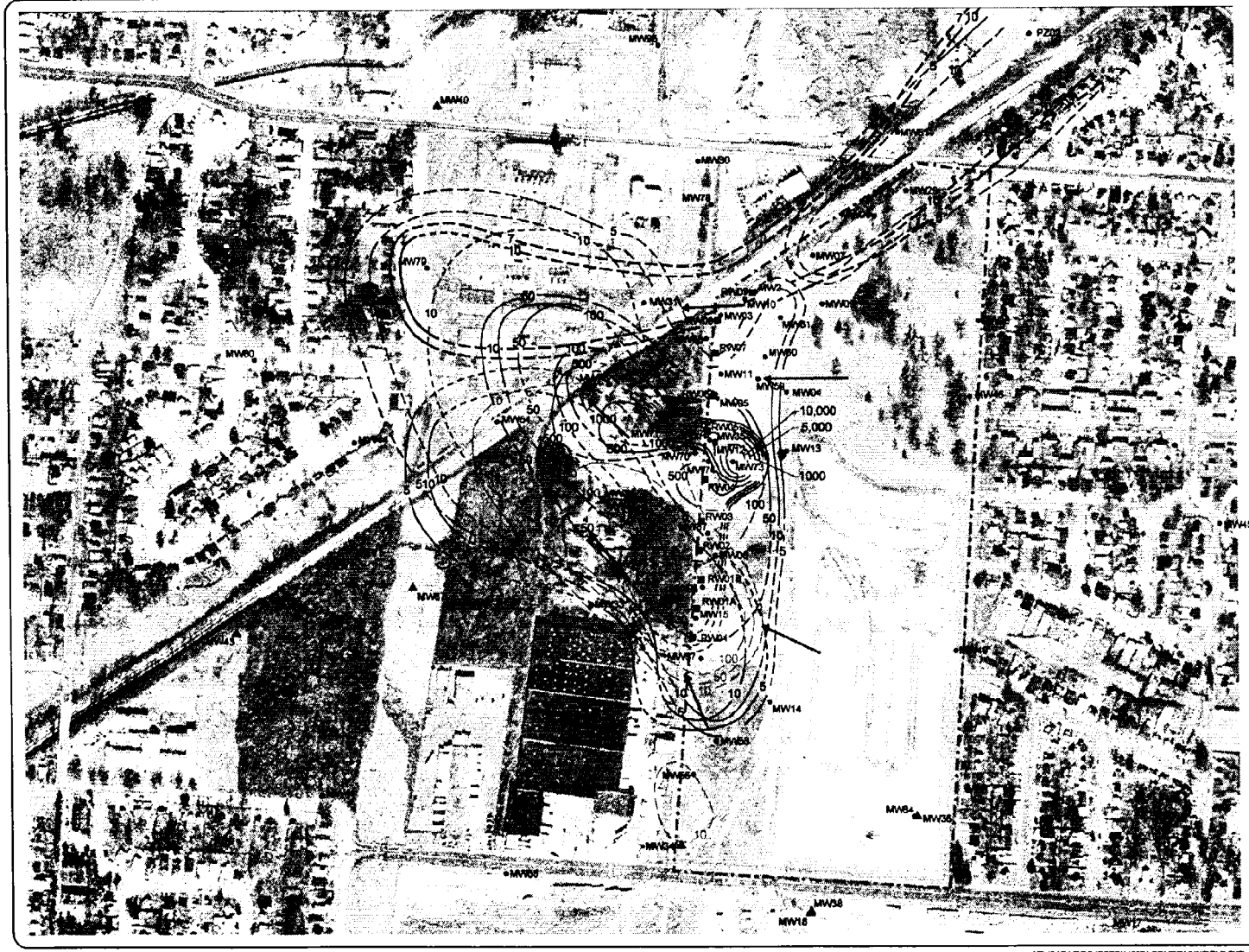

FIGURE 1-5
VOC COMPOSITE PLUME MAP
Rev. 1 Dunn Field Five Year Review

CH2MHILL

ATL/CAD1/PROJECTS/148071 DDMT/DUNNFIELD 5YR 27-NOV-2002 8071FIG1-5.dgn

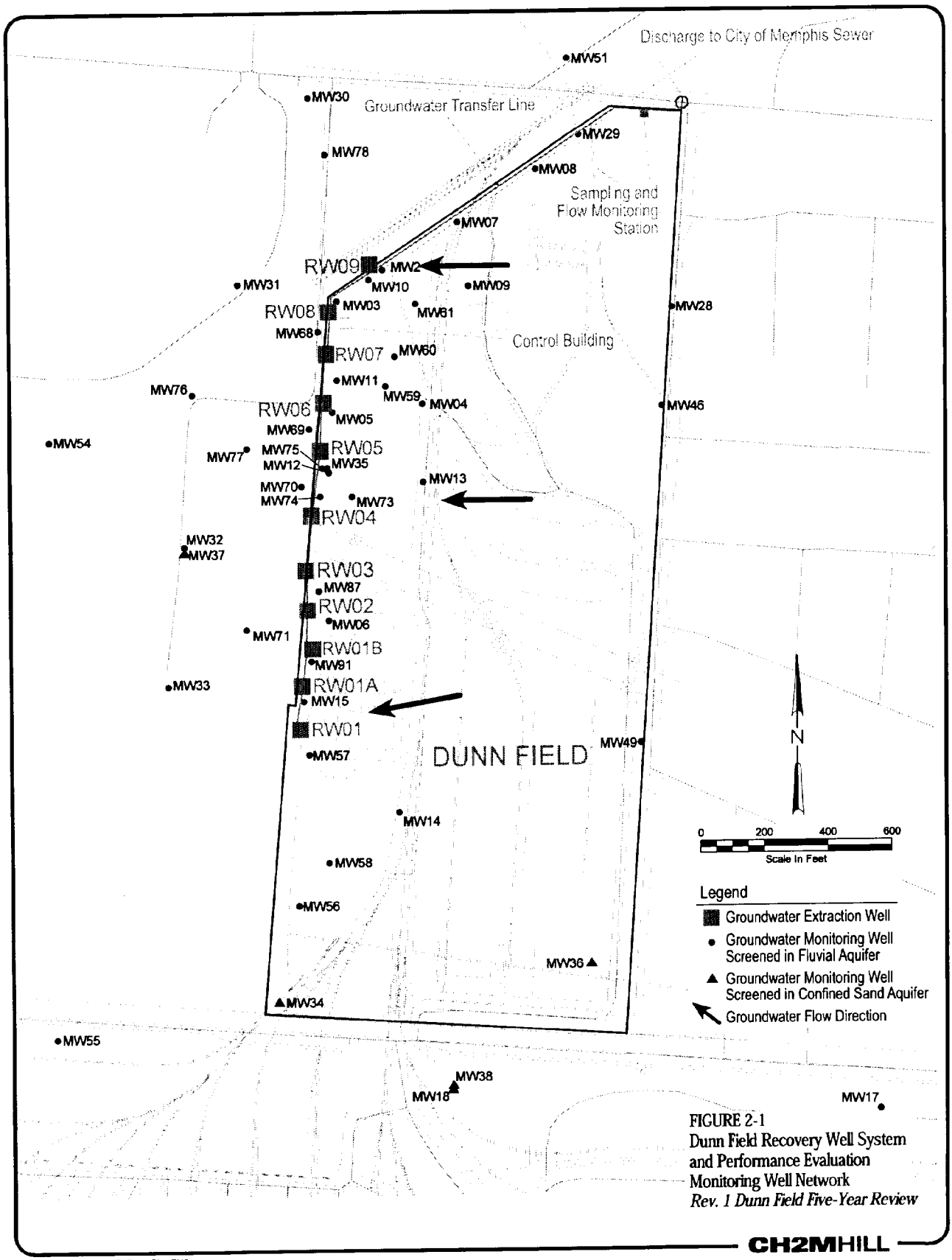

FIGURE 2-1
Dunn Field Recovery Well System and Performance Evaluation Monitoring Well Network
Rev. 1 Dunn Field Five-Year Review

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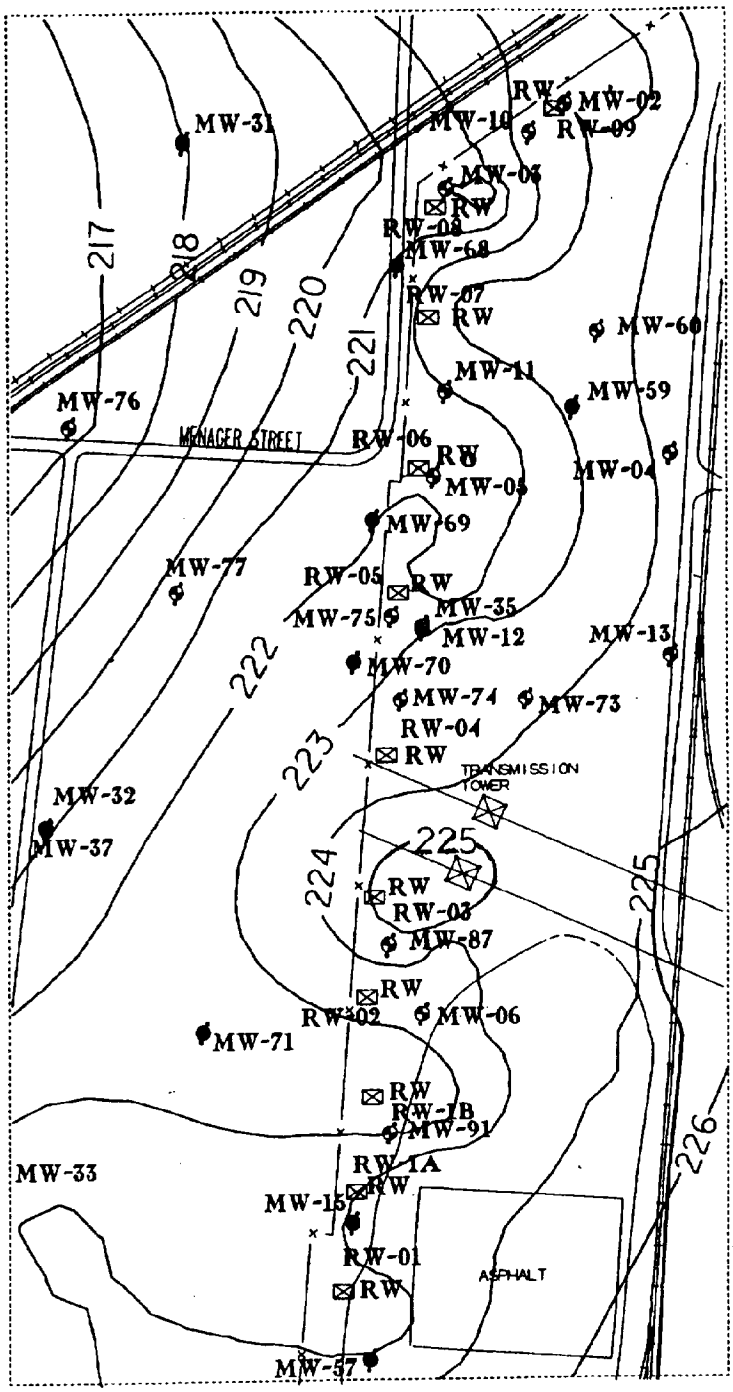
E022001012ATL/8071DunnSite.FH8



N

RECOVERY ZONE

SCALE FEET

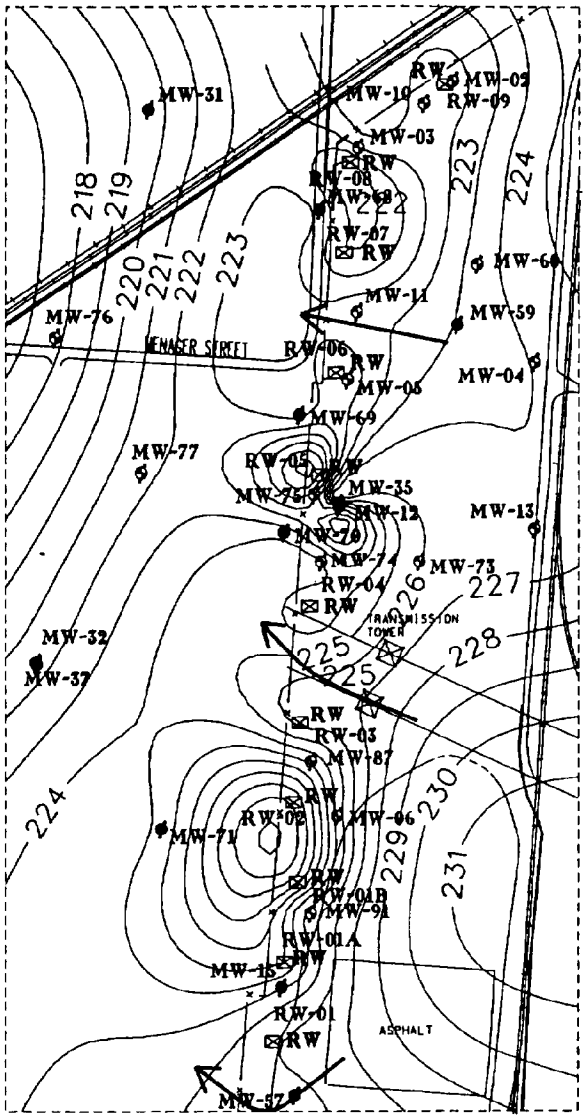
LEGEND

- MONITORING WELL
- SELECTED SAMPLING MONITORING WELL
- RECOVERY WELL
- 206 GROUNDWATER CONTOUR

* From Jacobs Engineering Inc., *Semi-Annual Groundwater Quality Report (Year Three, Second Half) Groundwater Interim Remedial Action, Dunn Field, Memphis Depot, Tennessee, February 2002.*

FIGURE 2-2
Potentiometric Surface Map for the Dunn Field Groundwater Extraction System
November 01, 2001
Rev. 1 Dunn Field Five - Year Review

CH2MHILL



LEGEND

- MONITORING WELL
- SELECTED SAMPLING MONITORING WELL
- RECOVERY WELL
- 206 GROUNDWATER CONTOUR
- POTENTIAL AREA OF INCOMPLETE HYDRAULIC CAPTURE

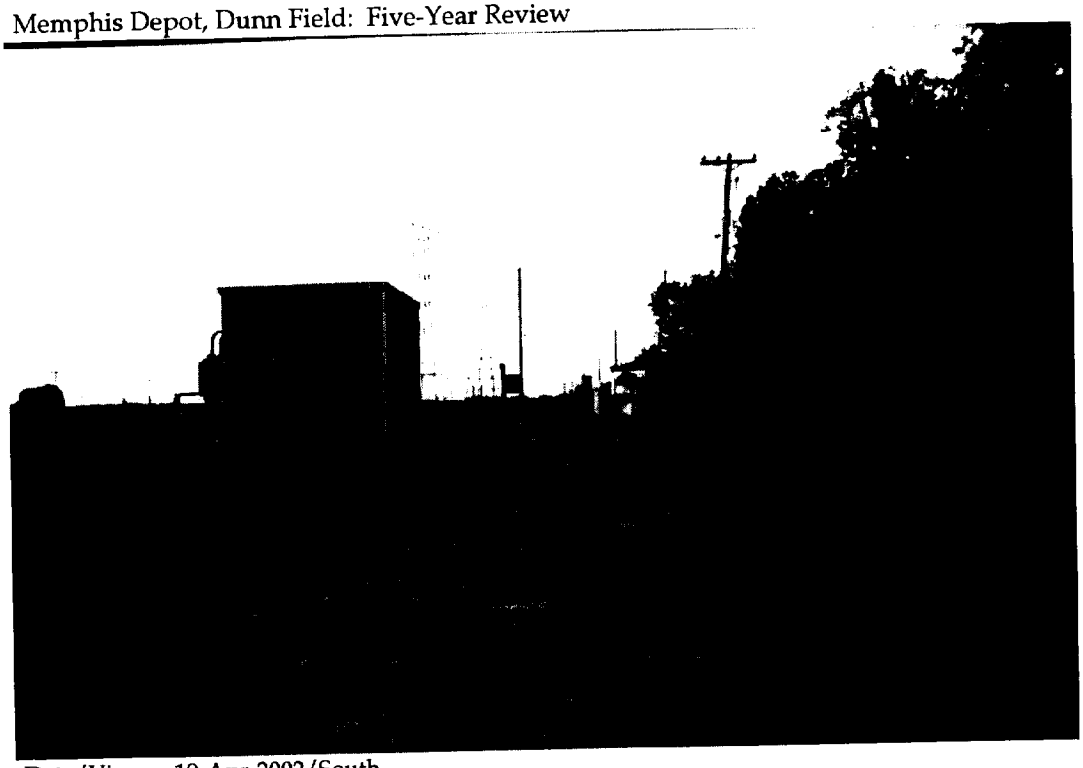
FIGURE 2-3
Potentiometric Surface Map for the
Dunn Field Groundwater Extraction System
May 1, 2002
Rev. 1 Dunn Field Five - Year Review
* Source: Jacobs Sverdrup Civil, Inc May - 2002

CH2MHILL

ATL/CAD1/PROJECTS/148071 DDMT/DUNNFIELD 5YR 54306g2-2.dgn

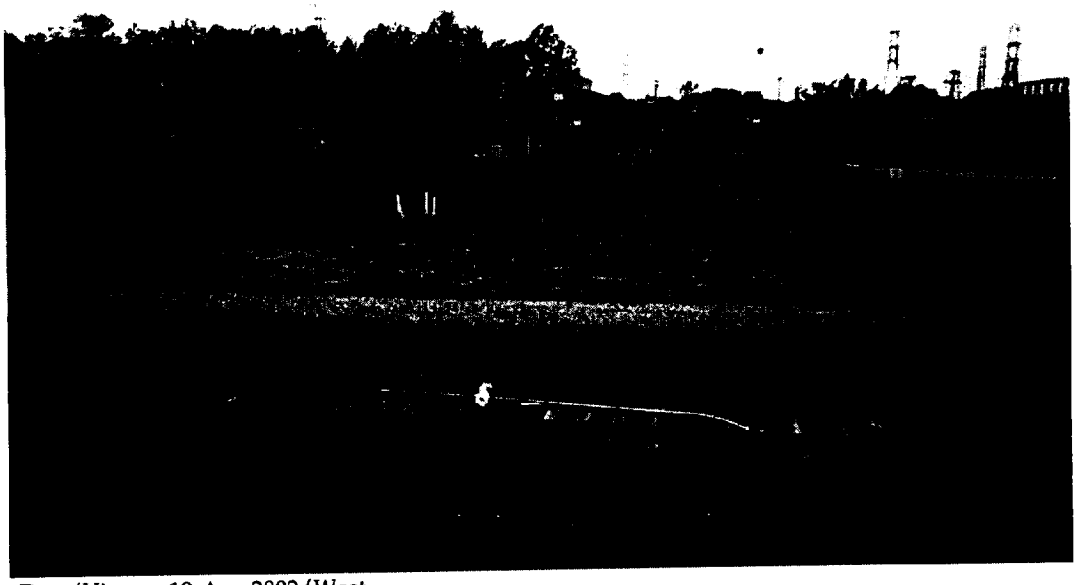
APPENDIX A

PHOTOGRAPHS (APRIL AND SEPTEMBER 2002)



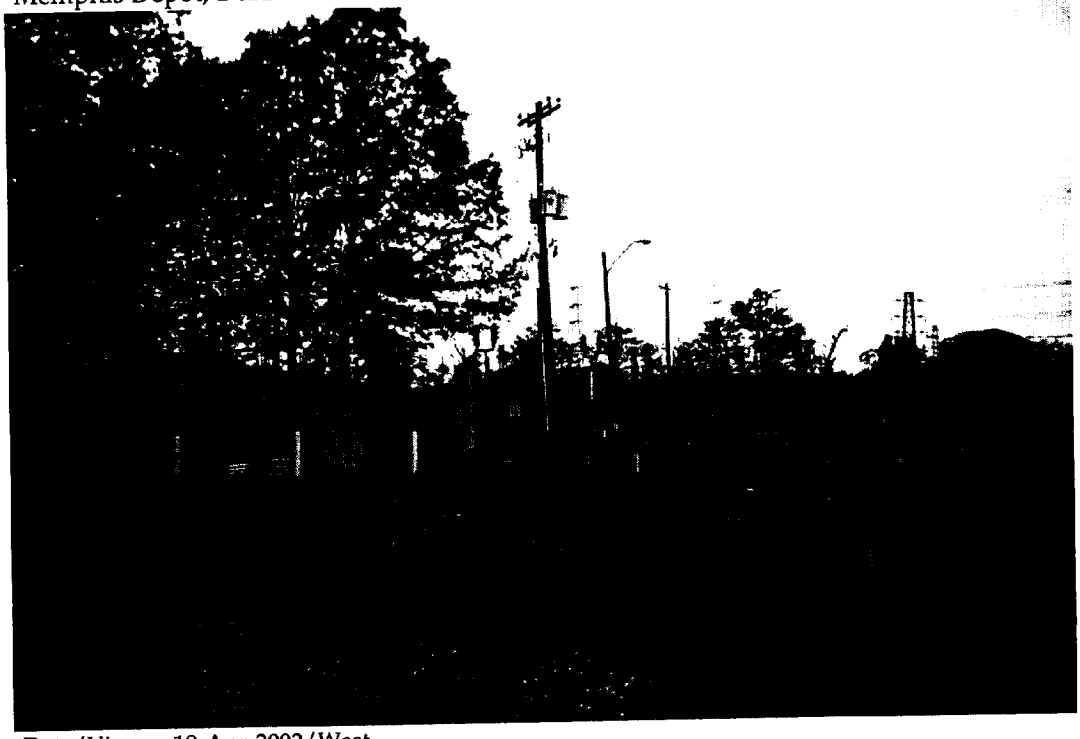
Date/View: 19-Apr-2002/South
Comment: View of the control building and recovery wells RW-07 and RW-06 in the background

Date/View: 19-Apr-2002/Northeast
Comment: View of the NW boundary of Dunn Field with recovery well RW-08 in the foreground and RW-09 in the background

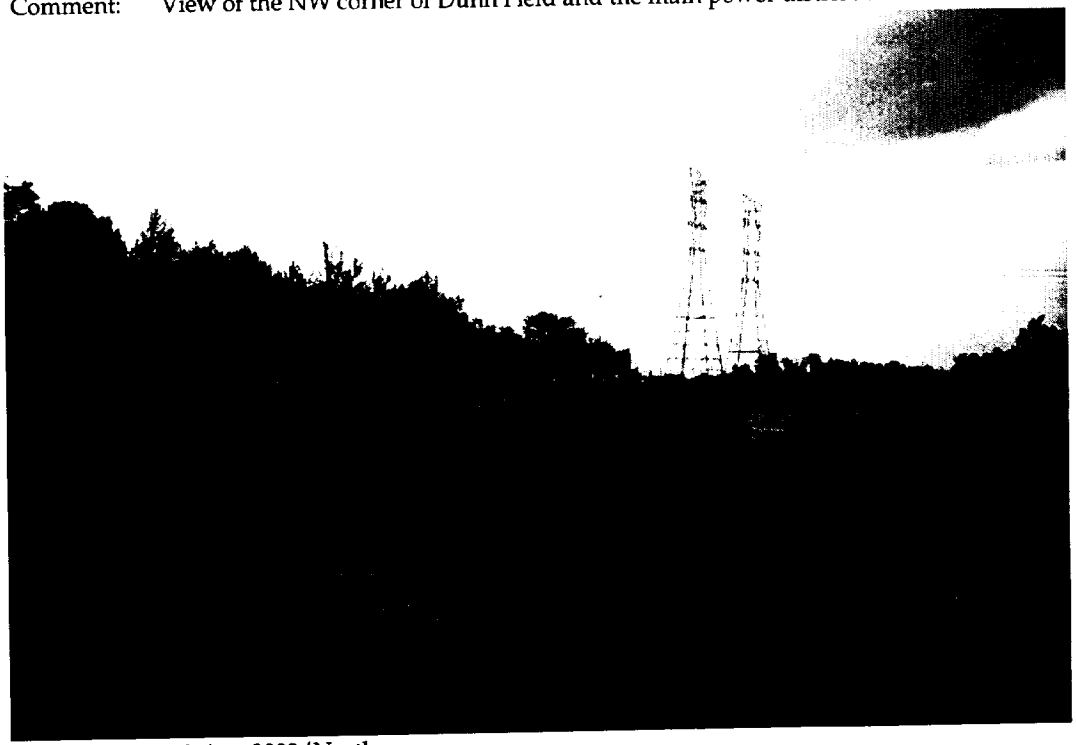


Date/View: 19-Apr-2002/West
Comment: View of the NW corner of Dunn Field and the control building, RW-07, -08 and -09

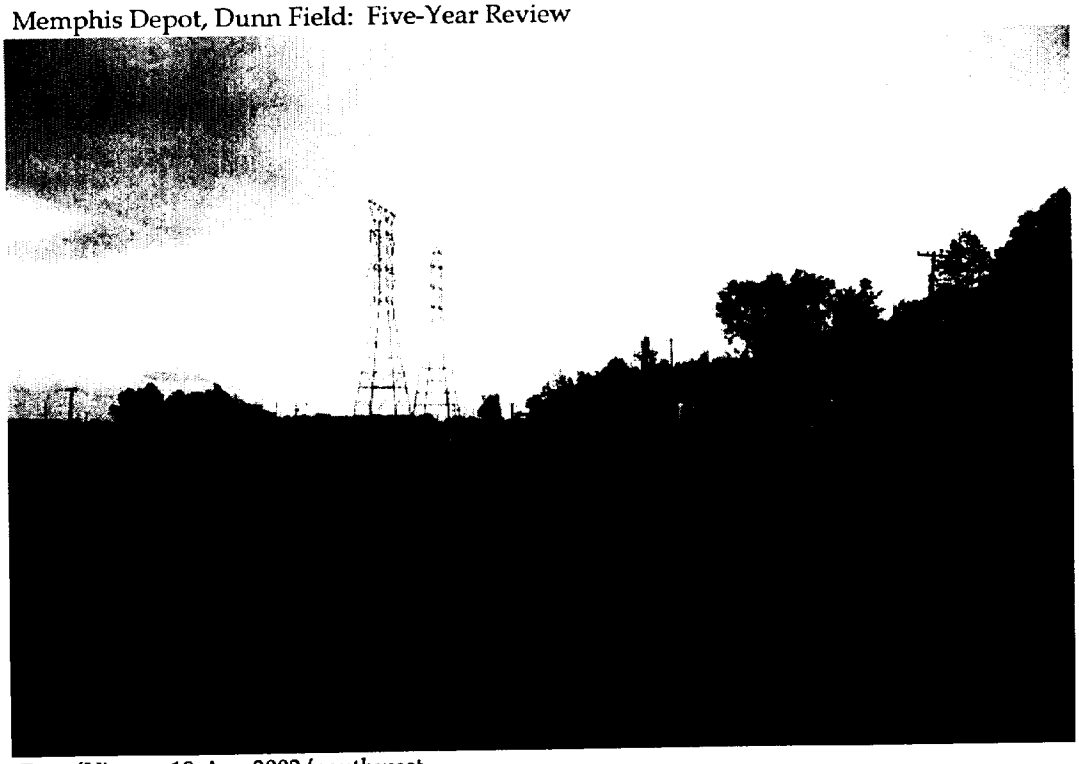
Date/View: 19-Apr-2002/Southwest
Comment: View of the W boundary of Dunn Field with RW-07, -06, -05, -04 and -03 in the background



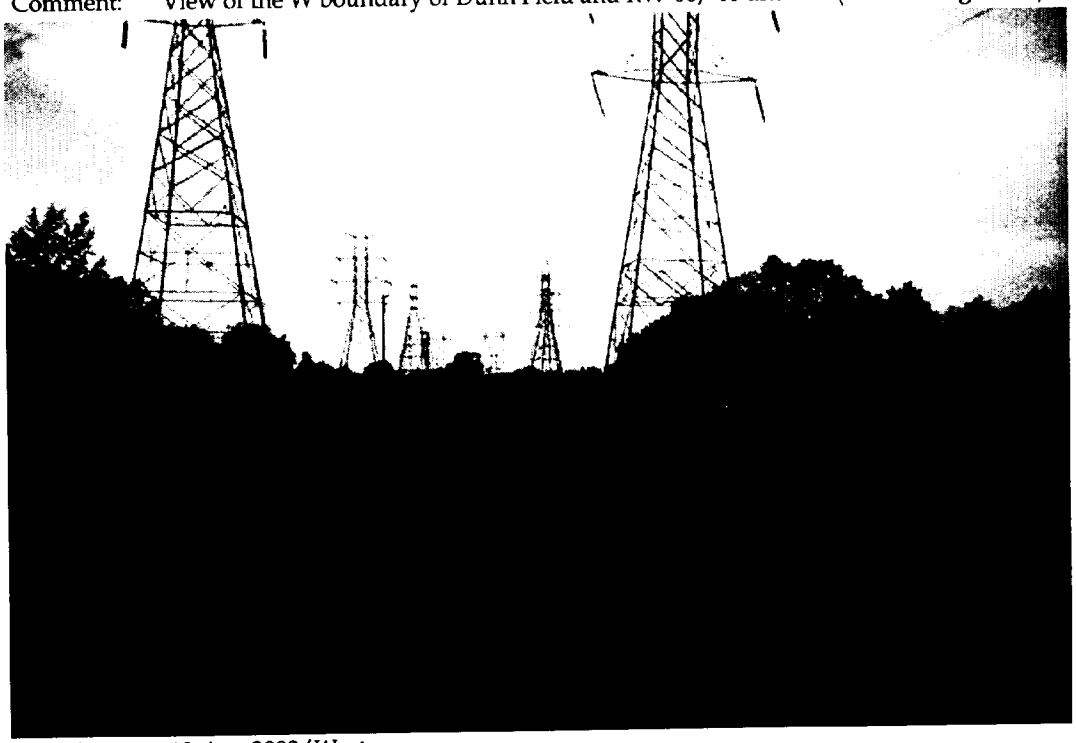
Date/View: 19-Apr-2002/West
Comment: View of the NW corner of Dunn Field and the main power distribution to Dunn Field



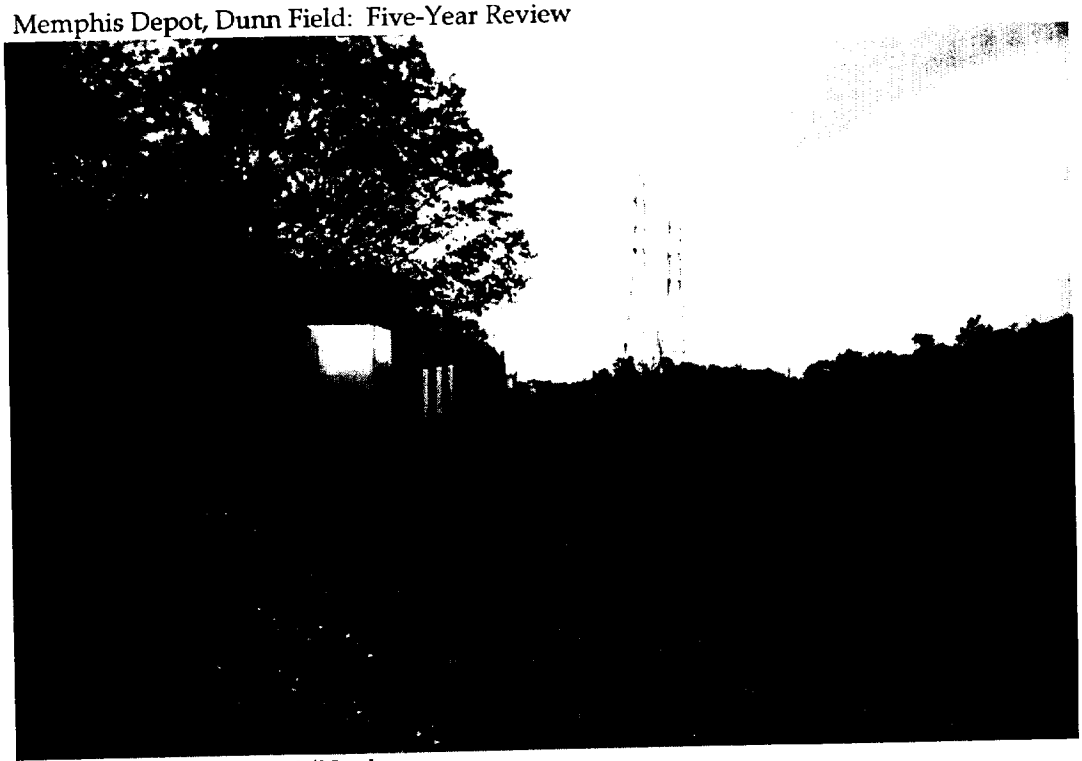
Date/View: 19-Apr-2002/North
Comment: View along the W boundary of Dunn Field with RW-01A (in the foreground), -02, -03, -04, -05, -06 and -07 (in the far background)



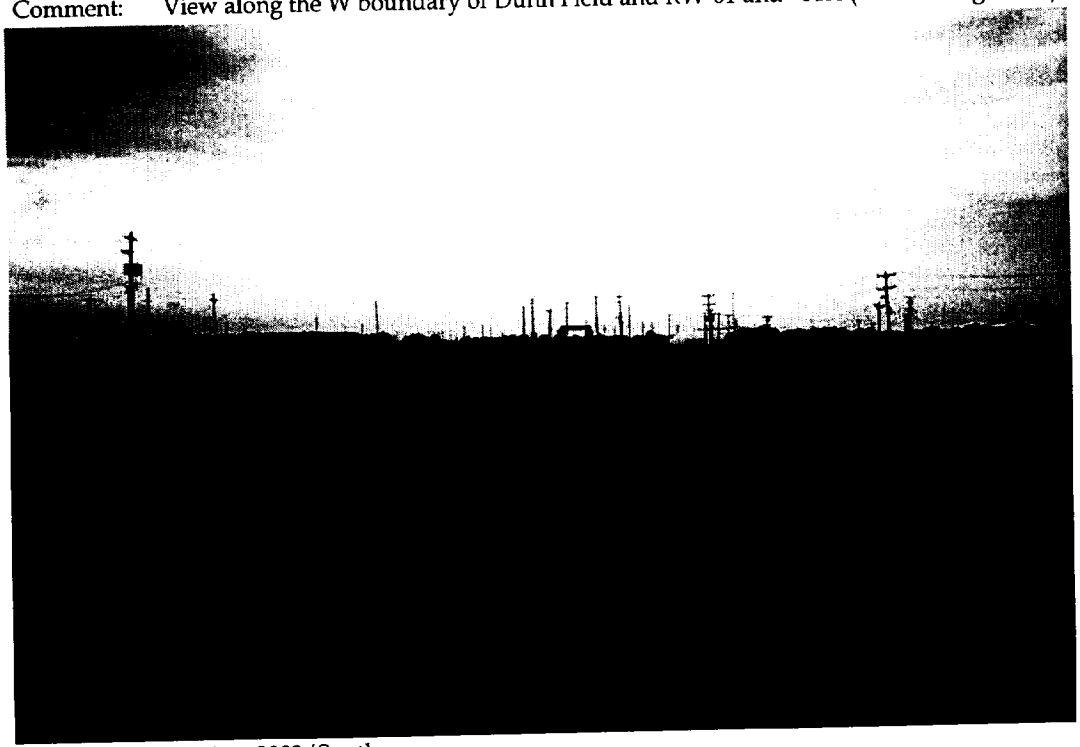
Date/View: 19-Apr-2002/southwest
Comment: View of the W boundary of Dunn Field and RW-06, -05 and -04 (in the background)



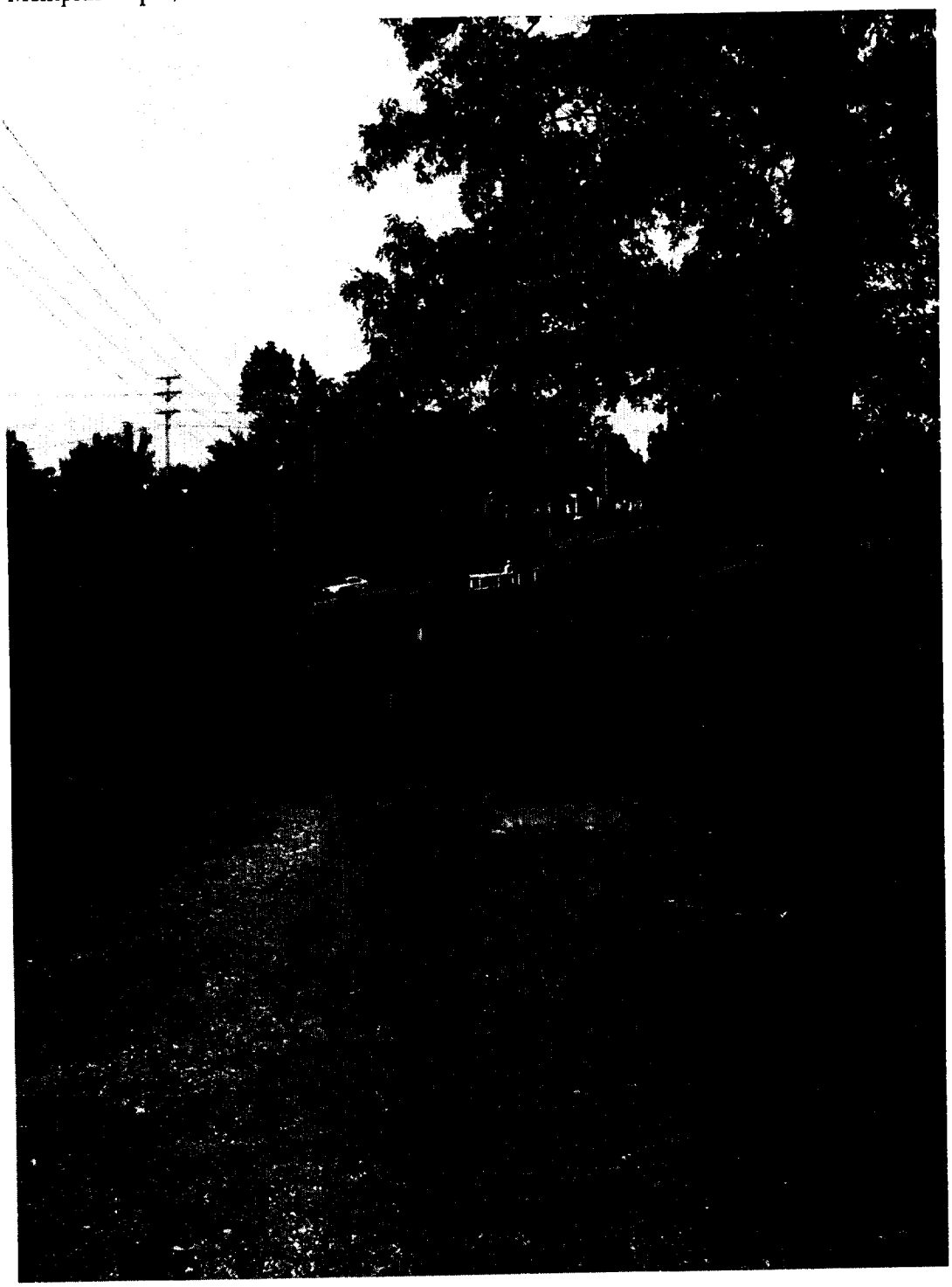
Date/View: 19-Apr-2002/West
Comment: View beneath the powerline corridor on Dunn Field with RW-04 (beneath the powerlines) and RW-05 (north of RW-04)



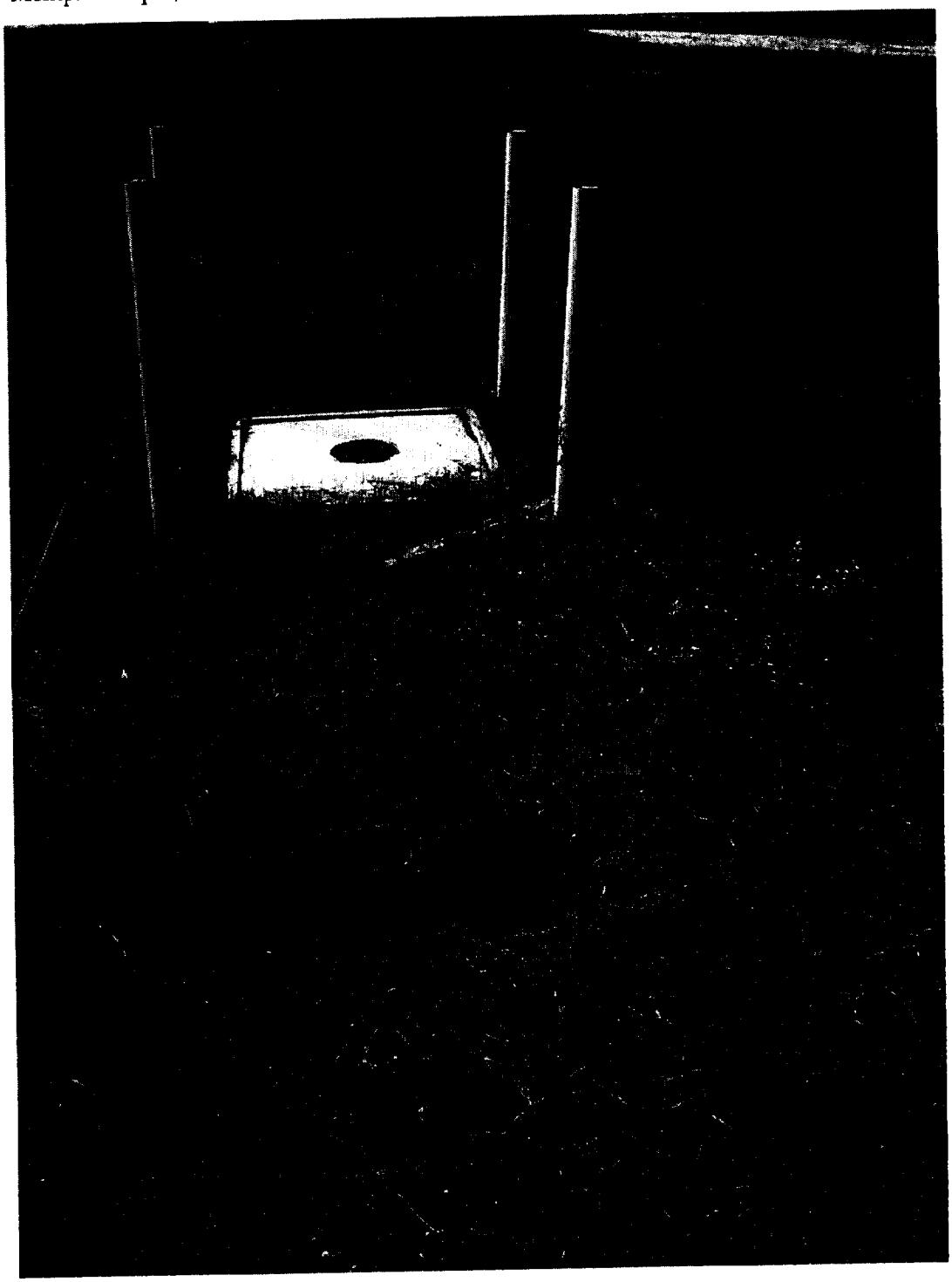
Date/View: 19-Apr-2002/North
Comment: View along the W boundary of Dunn Field and RW-01 and -01A (in the background)



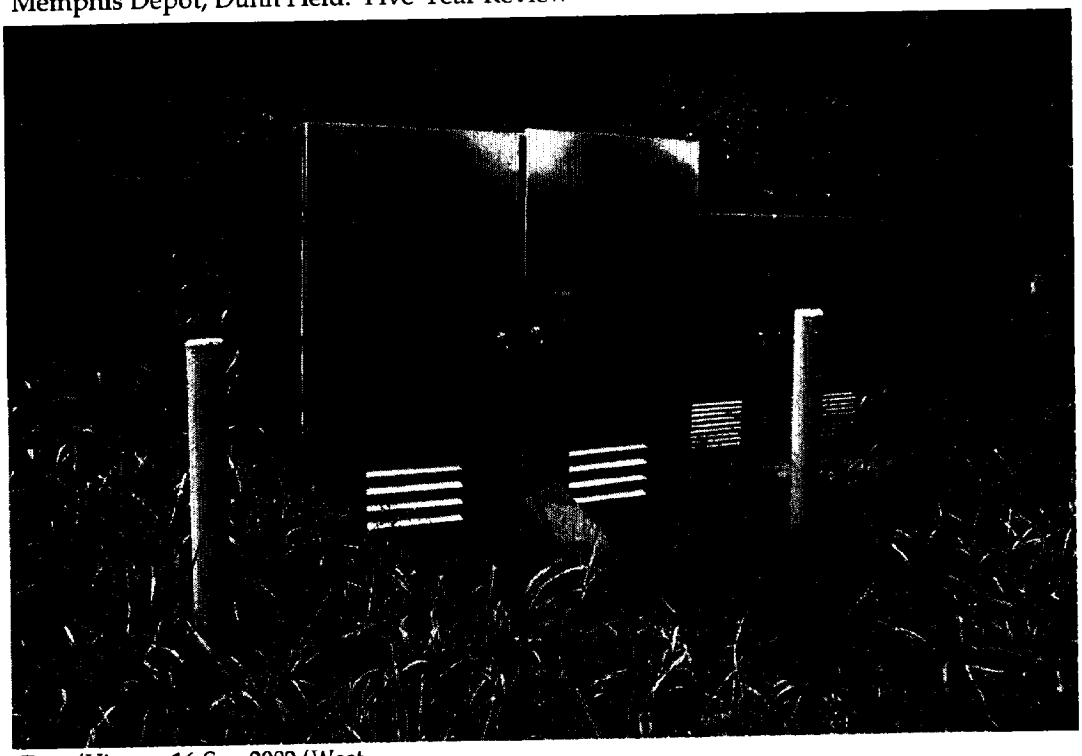
Date/View: 19-Apr-2002/South
Comment: View of the southern portion of the west half of Dunn Field



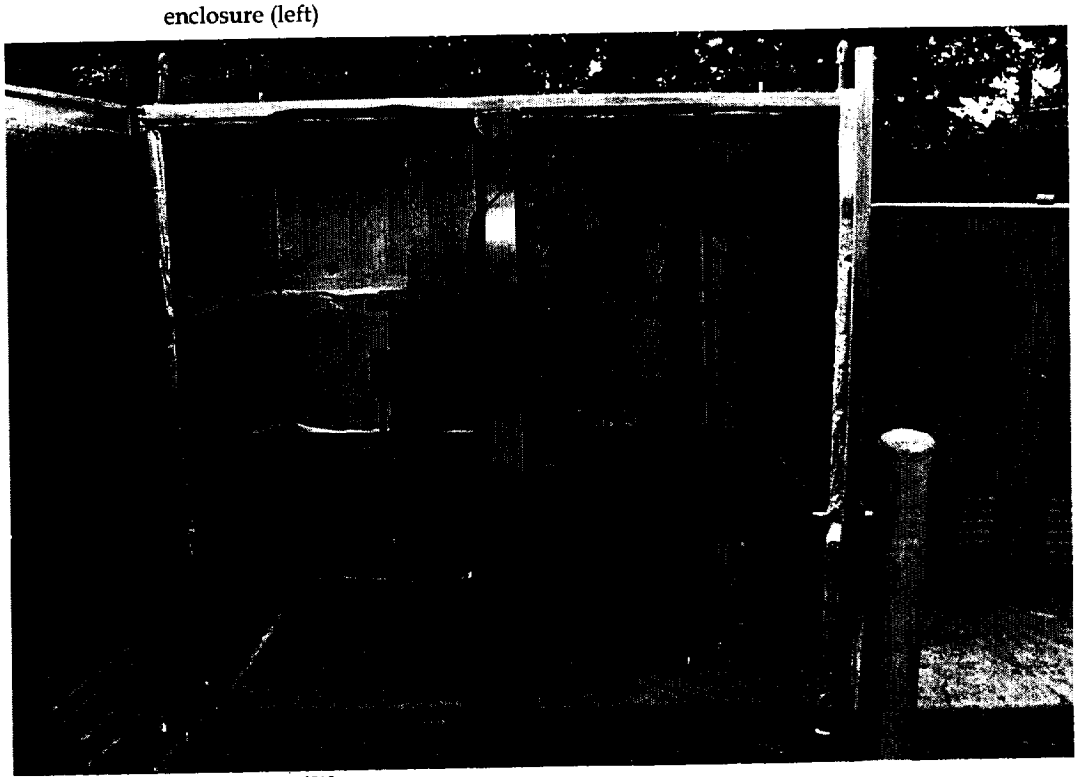
Date/View: 16-Sep-2002/Northwest
Comment: View along the N boundary of Dunn Field with the total effluent meter/by-pass station (in the background)



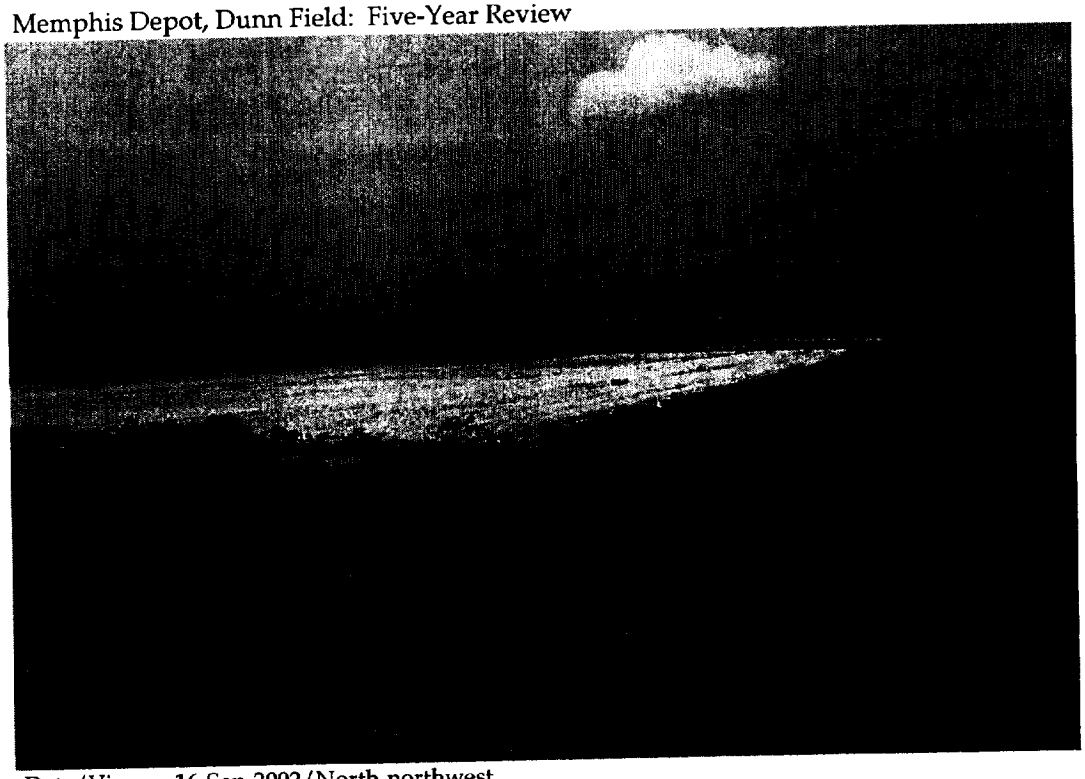
Date/View: 16-Sep-2002/West
Comment: View of an older monitoring well (MW-36 in the foreground) and a newer monitoring well (MW-84 in the background)



Date/View: 16-Sep-2002/West
Comment: View of the exterior of a wellhead assembly - control panel (right) and wellhead enclosure (left)



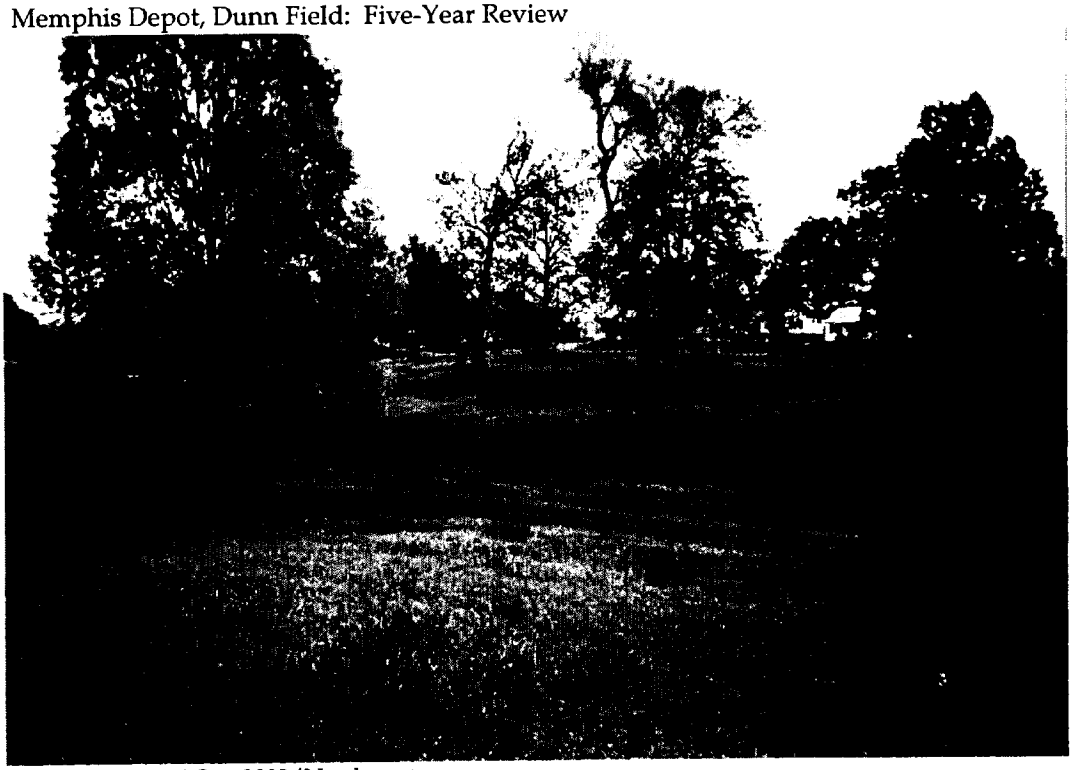
Date/View: 16-Sep-2002/West
Comment: View of the interior of a wellhead enclosure



Date/View: 16-Sep-2002/North-northwest
Comment: View of the southern portion of the west half of Dunn Field – former stockpile area

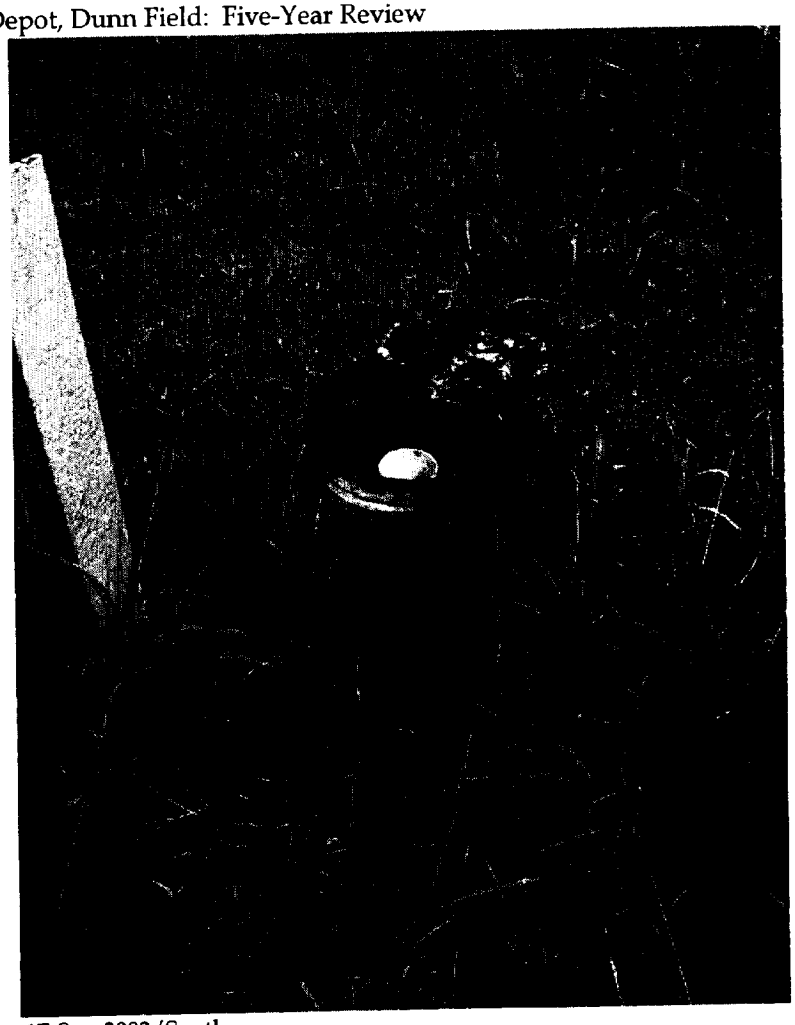
Date/View: 16-Sep-2002/South
Comment: View of the southern portion of the west half of Dunn Field

Memphis Depot, Dunn Field: Five-Year Review

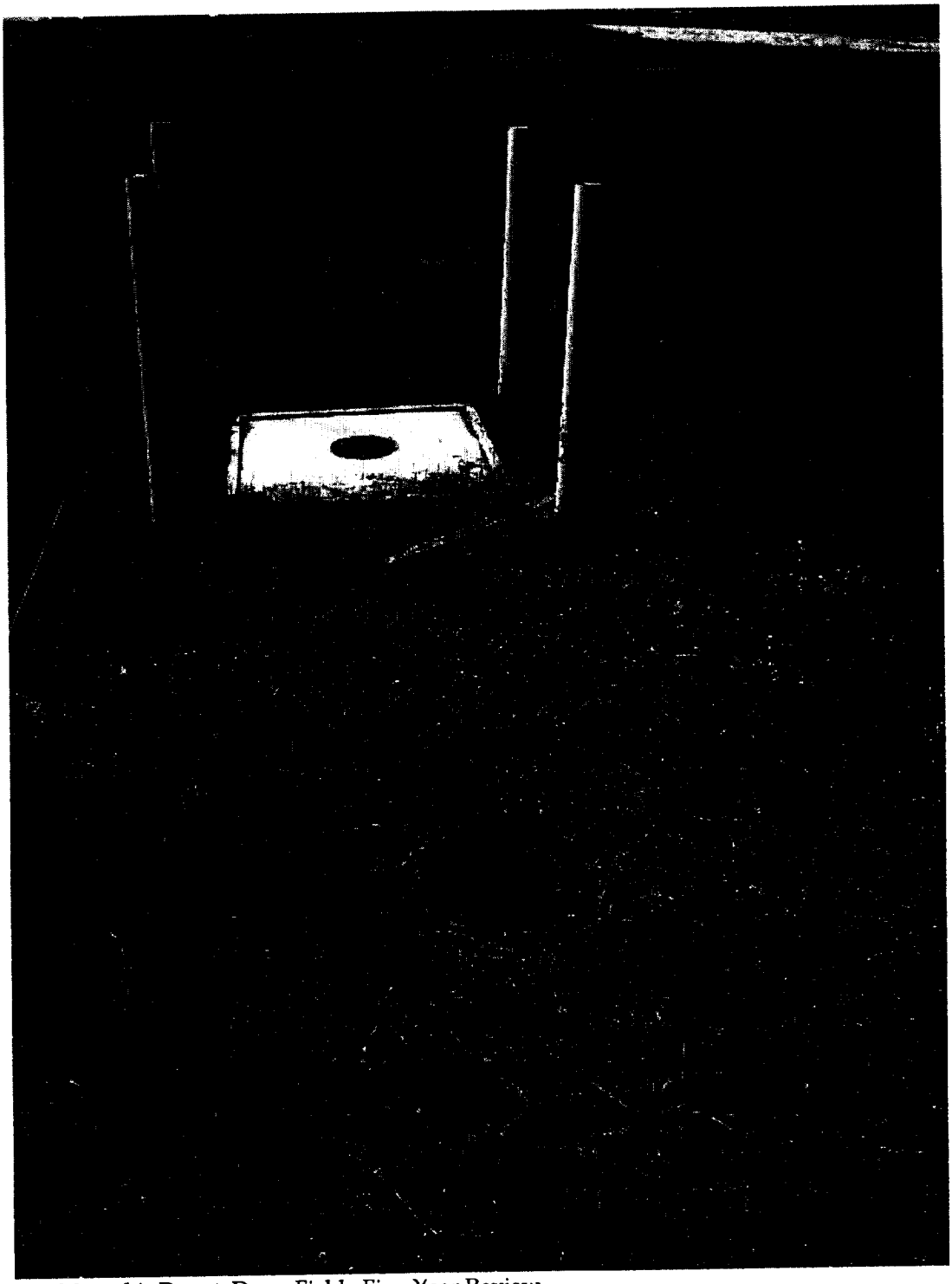


Date/View: 16-Sep-2002/Northwest
Comment: View of the northern portion of the west half of Dunn Field – Northeast Open Area

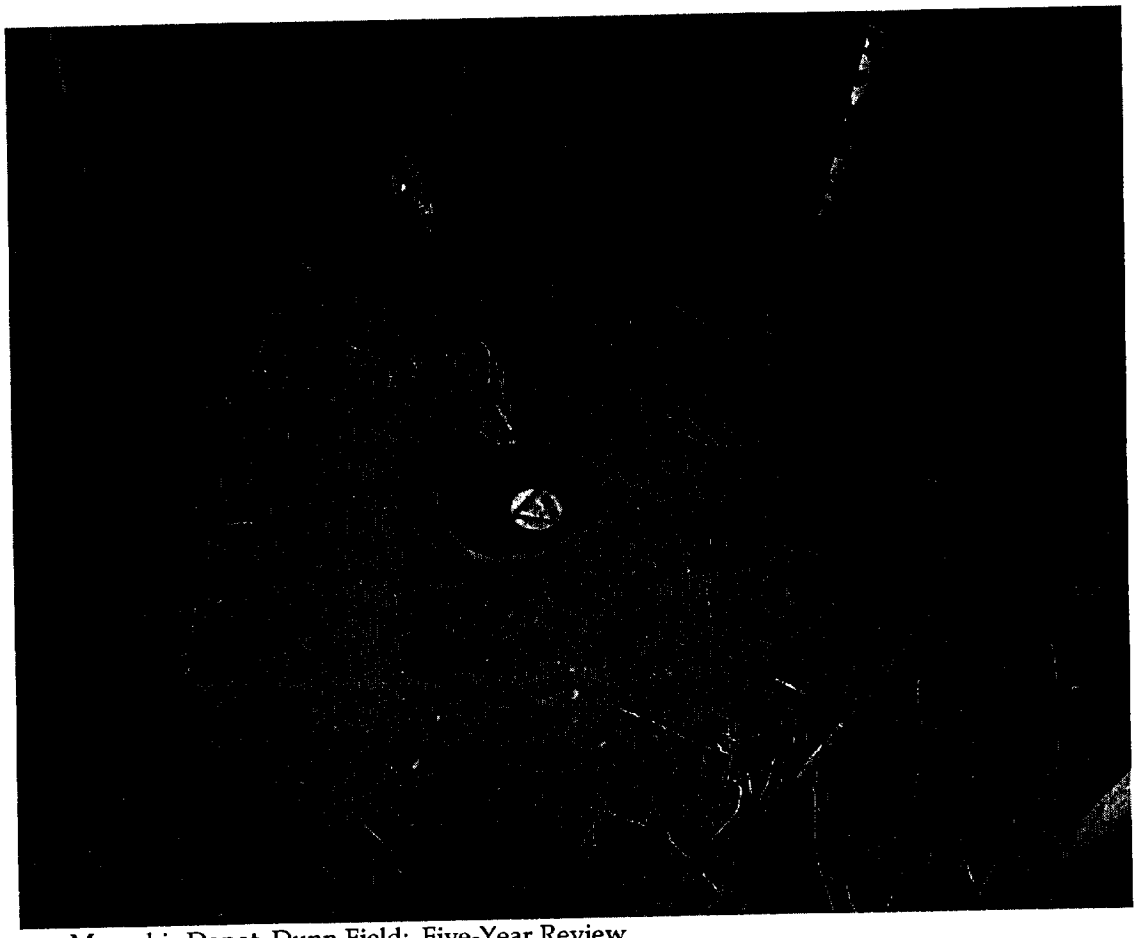
Memphis Depot, Dunn Field: Five-Year Review



Date/View: 17-Sep-2002/South
Comment: Status of MW-2, which requires locking capability and new well cap.



Memphis Depot, Dunn Field: Five-Year Review
Date/View: 17-Sep-2002/South
Comment: Status of MW-36 and MW-84 (foreground). MW-84 requires new concrete pad and flush mount manhole.



Memphis Depot, Dunn Field: Five-Year Review
Date/View: 17-Sep-2002/South
Comment: Status of MW-57, which requires new bolts in manhole to ensure integirty.

APPENDIX B

Revised Discharge Limits for the Groundwater Extraction System

DEFENSE LOGISTICS AGENCY
DEFENSE DEPOT SUSQUEHANNA PENNSYLVANIA
OL, MEMPHIS
2163 AIRWAYS BOULEVARD
MEMPHIS, TENNESSEE 38114

IN REPLY REFER TO DDSP-D

May 31, 2002

MEMORANDUM FOR Al-Chokhachi (City of Memphis Division of Public Works)

SUBJECT: Dunn Field Recovery Well System

As a follow-up to our conversation of Tuesday, May 21, 2002, I am providing additional information to your office on the Dunn Field Recovery System. The City of Memphis granted a permit to the former Memphis Depot to discharge groundwater pumped from under Dunn Field directly into the City's sewer system. The groundwater is pumped into a manhole at the intersection of Person Ave. and Hays Road. It was agreed that treatment of the water would not be required prior to discharge into the City system. Therefore, the groundwater is pumped directly into the City's sewer system without treatment.

In March of 2001, the system on Dunn Field was expanded from seven wells to eleven wells. The four additional wells were placed in areas determined to have the highest concentrations of contaminants. The concentration of chloroform has risen during recent samplings to around 50 ug/L, which exceeds the permit limits of 20 ug/L monthly average and 40 ug/L one time maximum. Additionally, the concentration of Cis 1,2-DCE has occasionally been above the monthly average of 50 ug/L, but has not exceeded the one time maximum of 100 ug/L.

The discharge rate from Dunn Field into the City sewer system is approximately 50 gpm or 72,000 gallons per day, which is then mixed with and diluted by the flows going to the treatment plant. It is requested that a revision to the permit be made to allow concentrations of chloroform and Cis 1,2-DCE , respectively as follows:

Chloroform: 100ug/L monthly average // 200ug/L one - time maximum

Cis 1, 2 – Dichloroethene: 80 ug/L monthly average
100 ug/L one - time maximum

We are committed to meeting all requirements, as necessary and we look forward to working with you and the Division of Public Works. For more information, please contact me at (901) 544-0617.

Sincerely,

CLYDE E. HUNT, JR
Remedial Program Manager

City of Memphis
TENNESSEE

DR. WILLIE W. HERENTON - Mayor
RICK MASSON - Chief Administrative Officer
DIVISION OF PUBLIC WORKS
JERRY R. COLLINS JR. - Director
Maynard C. Stiles Wastewater Treatment Plant

Tuesday, June 04, 2002

Mr. Clyde Hunt
Project Manager
Memphis Depot Caretaker
2163 Airways Boulevard
Memphis, Tennessee 38114

RE: Revised Industrial Wastewater Discharge Agreement Permit No. S-NN3-097
Memphis Depot Caretaker @ 2163 Airways Blvd., Memphis, Tennessee

Dear Mr. Hunt:

Please find enclosed the revised sections (D.3) of Memphis Depot Caretaker 's Industrial Wastewater Discharge Agreement for your review. This revision is to include new limits for Chloroform and Cis 1,2-Dichloroethne.

If you should have any questions, please feel free to contact me at (901) 353-2392.

Sincerely,

Akil AL-Chokhachi
Environmental Engineer

2303 North Second Street • Memphis, Tennessee 38127-7500 • (901) 353-2392

City Of Memphis
Industrial Wastewater Discharge Agreement

S-NN3-097
MEMPHIS DEPO

D.3 Priority Pollutants and other substances that may be present in the wastewater discharge

(See Appendix A for complete listing.)

PAGE 1 OF 2 Ground Water with a flow of 561,600 gallons / day

Parameter	PPN	Class	Daily Average (Monthly Average) Maximum Level mg/l	Daily Average (Monthly Average) Maximum Level lbs/day	Instantaneous (One Day) Maximum Level mg/l	Instantaneous (One Day) Maximum Level lbs/day
1,1,1-trichloroethane	11	Volat	0.010	0.047	0.020	0.094
1,1,2,2-tetrachloroethane	15	Volat	0.500	2.342	1.000	4.684
1,1,2-trichloroethane	14	Volat	0.050	0.234	0.100	0.468
1,1-dichloroethene		Volta	0.050	0.234	0.100	0.468
Aluminum		Metal	1.000	4.684	2.000	9.367
Arsenic	115	Metal	0.040	0.187	0.100	0.468
Bis (2-ethylhexyl) Phthalate	66	Semiv	0.010	0.047	0.020	0.094
Cadmium (total)	118	Metal	0.010	0.047	0.020	0.094
Carbon Tetrachloride (tetrachlor-)	6	Volat	0.020	0.094	0.040	0.187
Chloroform (trichloromethane)	23	Volat	0.100	0.468	0.200	0.937
Chromium (total)	119	Metal	0.200	0.937	0.400	1.873
Cis-1,2-dichloroethene		Volat	0.080	0.375	0.100	0.468
Copper (total)	120	Metal	0.200	0.937	0.400	1.873
Di-n-butyl Phthalate	68	Semiv	0.030	0.141	0.060	0.281
Iron		Metal	10.000	46.837	20.000	93.675
Lead (total)	122	Metal	0.150	0.703	0.300	1.405
Mercury	123	Metal	0.001	0.005	0.002	0.009
Methylene Chloride (dichlorometh-)	44	Volat	0.010	0.047	0.020	0.094
Naphthalene	55	Semiv	0.010	0.047	0.020	0.094
Nickel (total)	124	Metal	0.100	0.468	0.300	1.405
Phenol	65	Semiv	0.010	0.047	0.020	0.094
Tetrachloroethylene (perc- & Tet-)	85	Semiv	0.060	0.281	0.120	0.562
Toluene	86	Volat	0.020	0.094	0.040	0.187
Trans-1,2-dichloroethene		Volat	0.050	0.234	0.100	0.468
Trichloroethylene (trichloroethe-)	87	Volat	0.400	1.873	0.800	3.747